plating

JOURNAL OF THE AMERICAN ELECTROPLATERS' SOCIETY

DECEMBER
1959

SEASON'S

University Microfilms
313 N. First St.
Ann Arbor, Michigan

Some of the Many **CLEPO** Tumbling Compounds Available

HOW TO CHOOSE AN ABRASIVE TUMBLING COMPOUND

Whatever your abrasive tumbling application, here's how to select the exact compound to meet your requirements:

1. Choose from a broad line of compounds developed by barrel finishing specialists.
2. Have a barrel finishing expert work with you to assure top product performance in the application.

When you buy a CLEPO abrasive tumbling compound, you get both.

Special compounds for unusual requirements are designed in the Gumm testing and research laboratories and barrel-tumbling pilot plant.

CLEPO 171-A	For polishing hardened steels to produce extremely low microinch finish
CLEPO 14-W	For light cutting and removing fine burrs from brass or copper
CLEPO 14-R	For medium cutting and deburring of steel, brass, copper
CLEPO 205-J	For fast cutting of the hardest steel and alloys
CLEPO 214-A	For long heavy grinding of sand castings and steel
CLEPO 19-D	For rough cutting steel to produce heavy matte finish

For complete data on barrel finishing, 20-page CLEPO Barrel Finishing Manual available on letterhead request.

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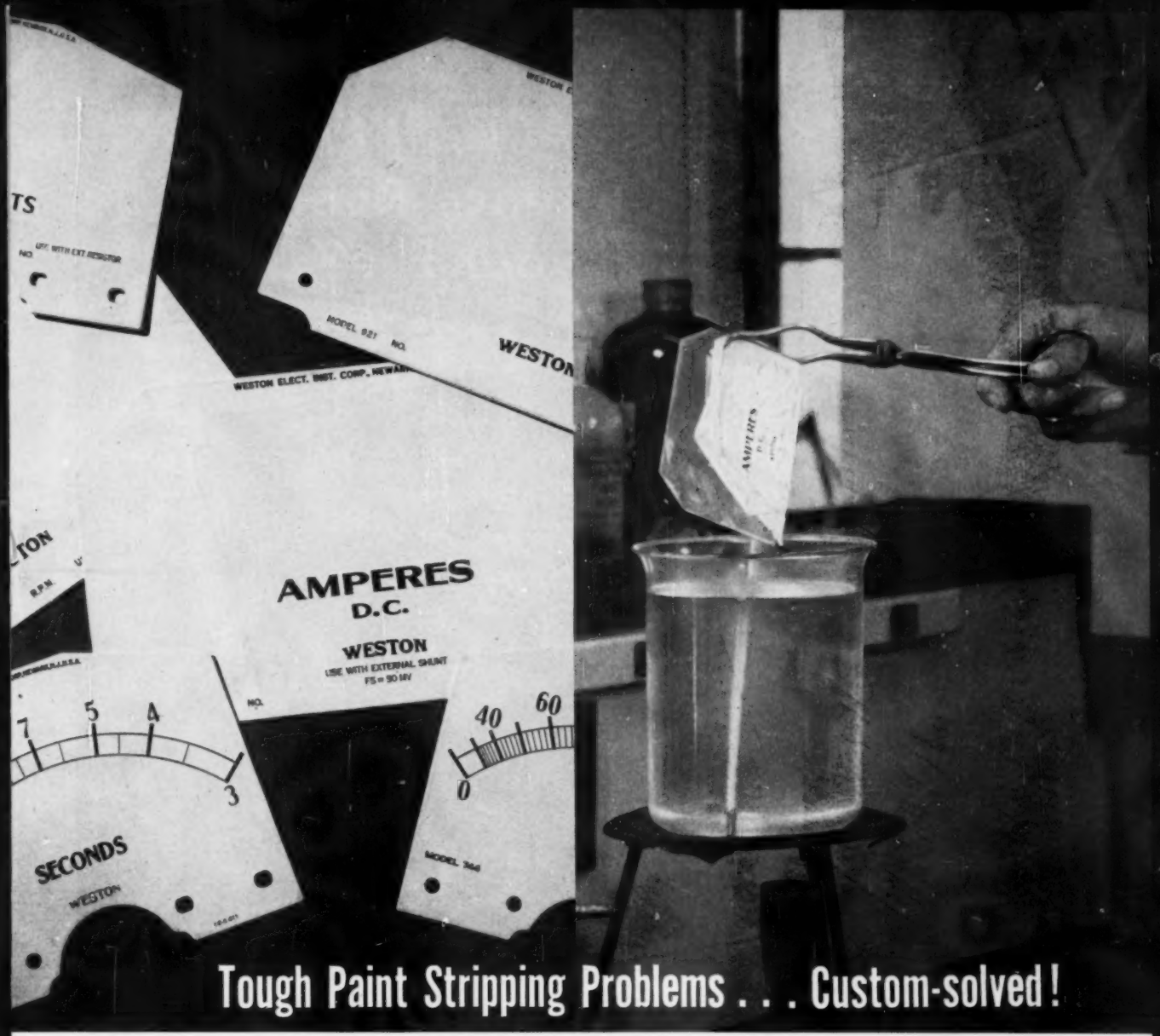

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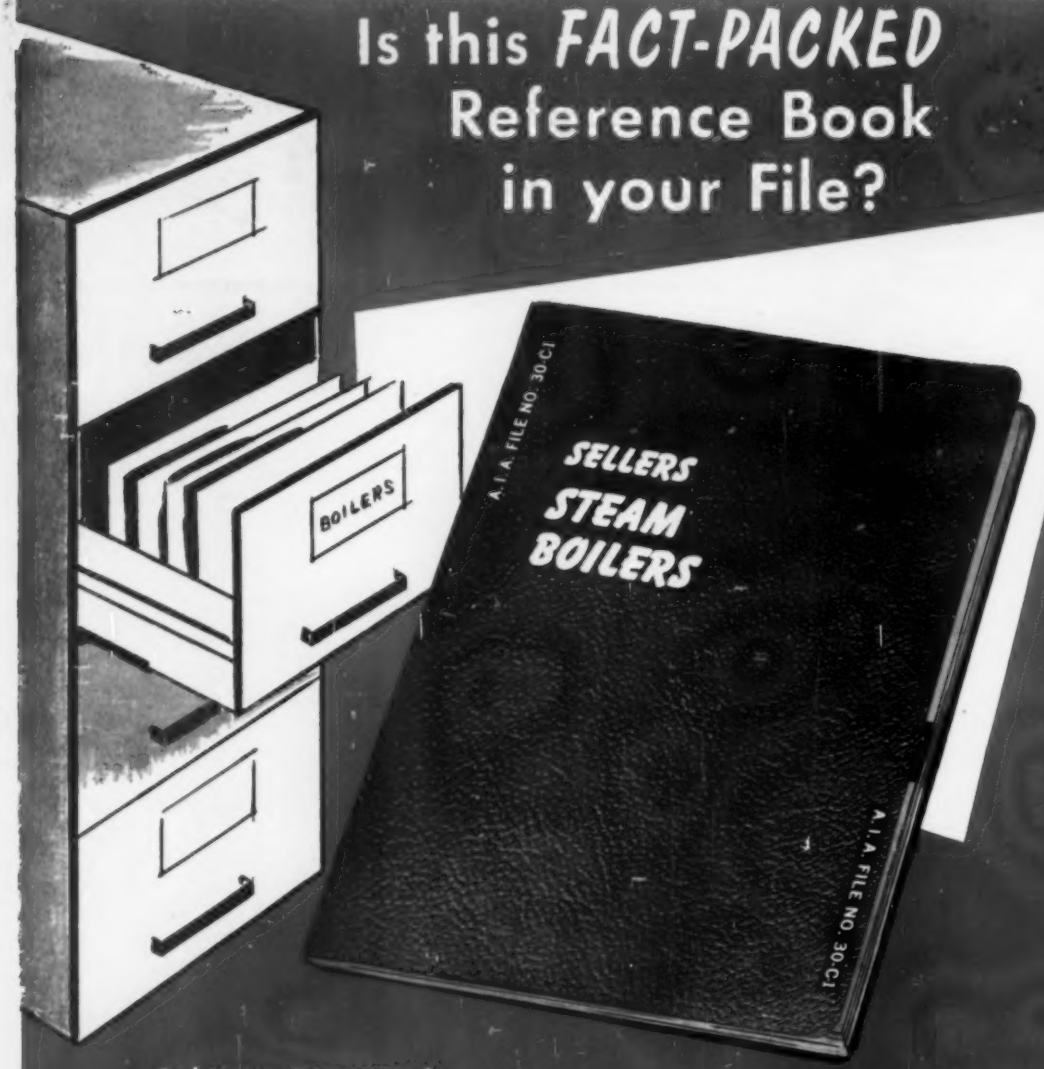

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JOURNAL OF THE AMERICAN ELECTROPLATERS' SOCIETY

DECEMBER 1959 — **Vol. 46, No. 12**

EDITORIAL

A Pause to Refresh 1333
by John P. Nichols

Automatic Flat Basket Plating 1359
by G. J. Marotta

Corrosion Data for Chemical Nickel Plating 1364
by J. Robert Spraul

A Literature Review on the Use of Molybdenum as an Alloy in Electrodeposits 1370
by Janet Z. Briggs and H. W. Schultze

An Outline of the Chemistry Involved in the Process of Catalytic Nickel Deposition from Aqueous Solution (Part III) 1377
by G. Gutzeit

ASTM, Committee B-8 Semi-Annual Meeting 1381
Summary *by E. B. Saubestre*

Tentative Educational Sessions Program for 1960 AES Convention 1382

Interim Meeting Reporter 1387

AES Directory	1427	Future Meetings	1426
AES Membership Report	1424	Industry News	1392
AES NEWS	1385	Industry News Briefs	1400
Article References	1354	Index to Advertisers	1436
Branch Directory Changes	1425	Intersociety News	1390
Branch News	1414	Patent Abstracts	1402
Classified Advertisements	1425	Personals	1412
Equipment and Supplies	1406	Trade Literature	1410

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EDITORIAL

A PAUSE TO REFRESH

FOR YEARS, from thousands of billboards and elsewhere, a prominent company's advertisements have beckoned us to take the "Pause that Refreshes." Broadening the thought's application, it is refreshing to pause from time to time, to assess yesterday's progress as an assist in charting today's and tomorrow's further surge. And as a random beginning point from which to appraise our national business development, consider, for instance, these Office Rules of a company of the 1870's:

1. Employees will daily sweep floors, dust the furniture and shelves.
2. Each day, fill lamps, clean chimneys and trim wicks. Wash windows once a week.
3. Each clerk will bring in a bucket of water and a scuttle of coal for the day's business.
4. Make your pens carefully. You may whittle nibs to your individual taste.
5. The office will open at 7 a.m. and close at 8 p.m. daily except on the Sabbath. Each employee is expected to spend the Sabbath by attending church and contributing liberally to the cause of the Lord.
6. Men employees will be given an evening off each week for courting purposes, or two evenings a week if they go regularly to church.
7. After an employee has spent his hours of labor in the office, he should spend time reading the Bible and other good books.
8. Any employee who smokes Spanish cigars, uses liquor, gets shaved in a barber shop or frequents pool halls will thereby give us good reason to suspect his worth, integrity and honesty.
9. The employee who has performed his labors faithfully and faultlessly for a period of five years, and who has been thrifty and religious, will be given a five cents per day increase, provided a just return in profit from the business permits it.

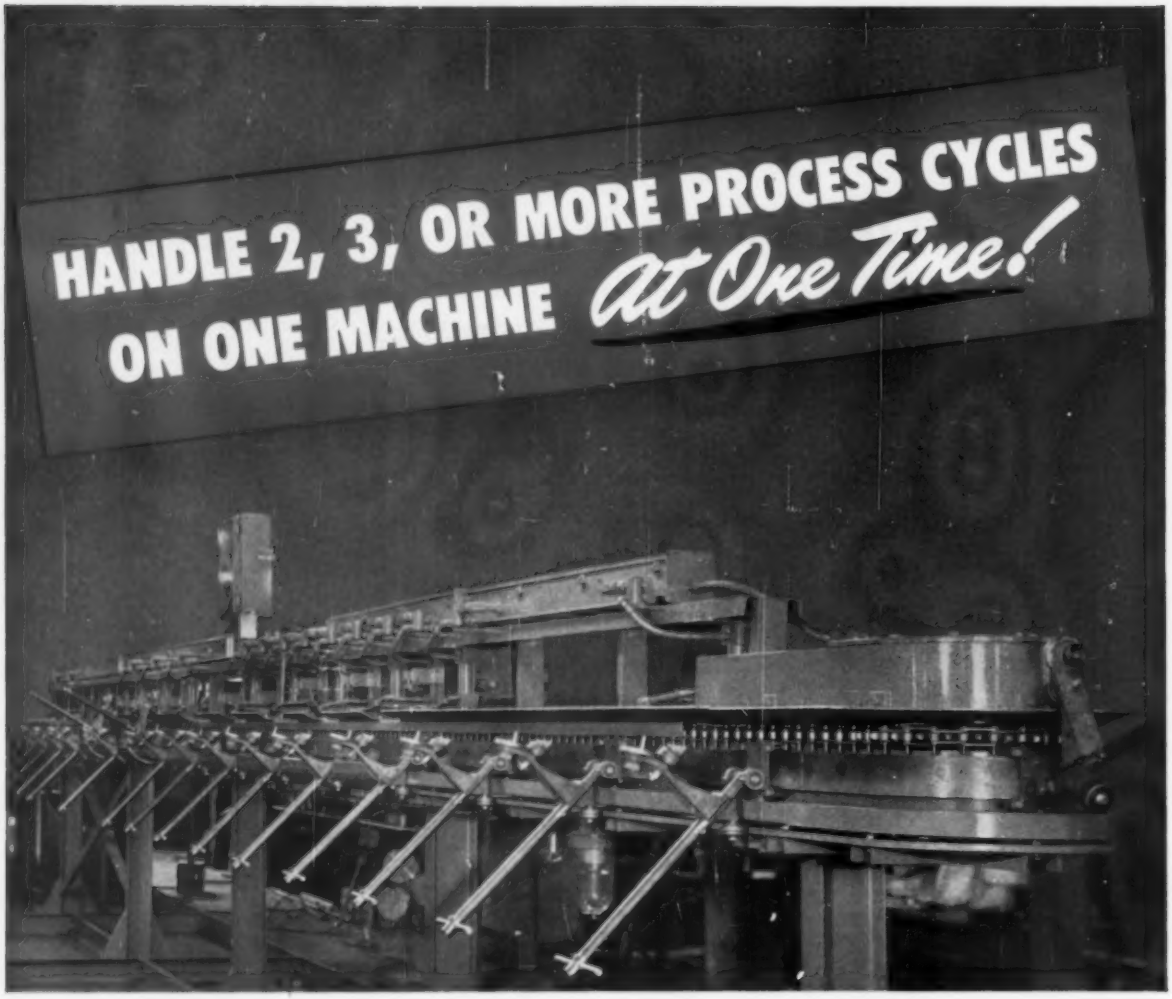
American business, knowing that the law of life, of service, of survival, is the law of change and constant improvement to meet the new and increasing demands of an expanding and complex civilization, has advanced prodigiously since that 1870 era. Broad perspective, modern policies and constant concentration upon streamlining business methods and techniques—upon enhancing research and development—upon enriching scientific and technical knowledge, competence and ingenuity—were enabling assists and are, in effect, essentials of continued national and individual progress.

The enterprises composing the field of electroplating, metal finishing and allied arts—the men and women comprising these enterprises—the Societies, Associations and publications serving them—have all shared in this field's contribution to the public interest through the years and, therefore, to the substantial progress that it has made. Its horizons are still unlimited.

To each of these, as all of us pause to refresh at Christmastime, PLATING MAGAZINE extends its hearty best wishes for a happy 1959 holiday season and for large and prosperous strides forward in 1960.

John P. Nichols

Chairman, Editorial Board
and Managing Editor



LASALCO'S *Select-O-Matic*

MULTIPLE PROCESS PLATER

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The FACTS thus obtained are issued in ABC reports which show how much circulation we have (largest paid circulation in this field)—how it was obtained—where it is distributed (mainly in the concentration areas of electroplating and metal finishing)—our paid subscription renewal percentage (highest in our field)—and other information that tells businessmen what they get for their advertising money when they invest in PLATING MAGAZINE's advertising columns.

ASK to see a copy of our ABC report.

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JOURNAL OF THE AMERICAN ELECTROPLATERS' SOCIETY

NOW!–Stevens *ALL NEW* Barrel of "MIRACLE" MATERIAL STEVALITE

LIGHTER STRONGER LONGER LASTING

Here's Why Stevens Can Offer You a Barrel superior to anything else on the market today:

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Stevalite . . . tremendous impact strength . . . heat resistance to 270° F. 50% lighter than any other material.

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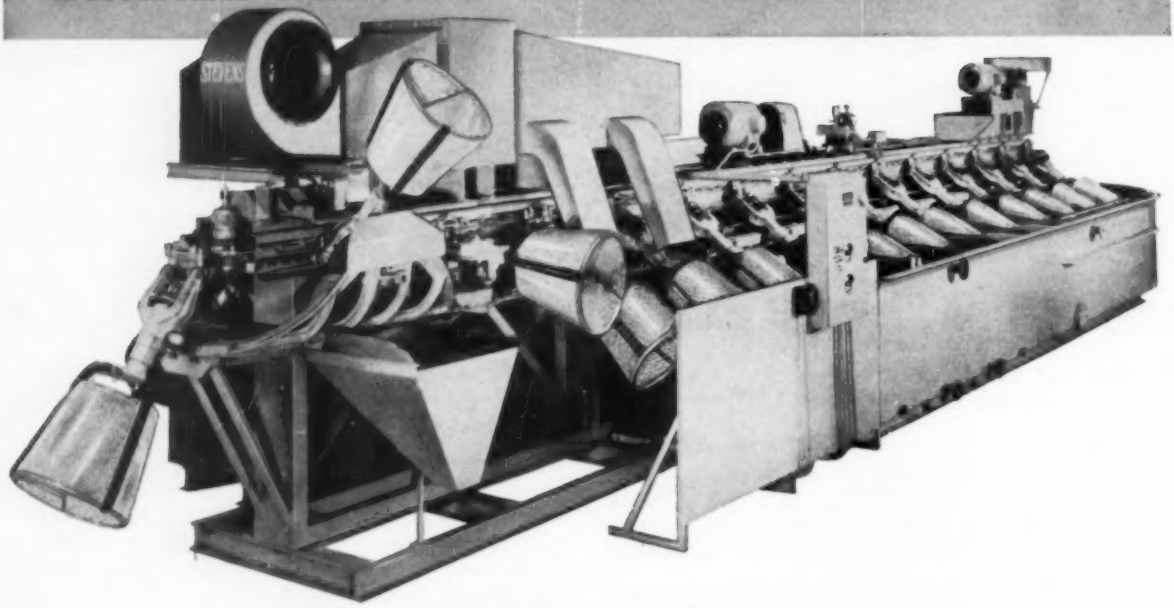
Oblique barrel tumbles parts more effectively giving improved plate distribution. Thinner wall decreases solution dragout. Dense perforation count boosts current draw and plating speed up to 30%. Faster drying.

THE CONSTRUCTION

Rigid, rugged *all welded* . . . unaffected by heat distortion . . . reinforced to resist damage. Minimum number of necessary parts.

You cannot buy a more efficient and productive barrel anywhere. Simple in conception and construction, it can guarantee you real maintenance-free performance and long productive life . . . the perfect barrel.

FOR USE ON ALL STEVENS AUTOMATIC BARREL PLATING-PROCESSING MACHINES



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BUFFALO CHICAGO DETROIT CLEVELAND
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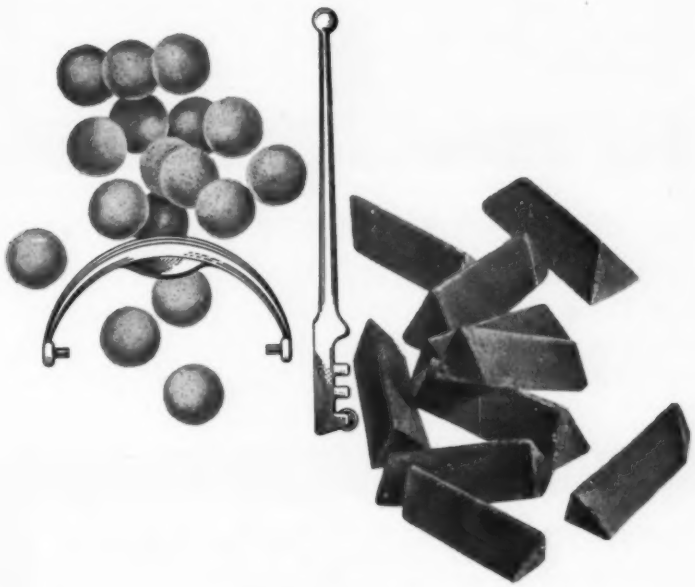
Remember — **When you go *automatic* . . . go STEVENS!**

Barrel Finishing is best finishing

...with TUMBLEX bonded abrasives*



Your sure way to cut finishing costs-per-piece is to combine the best barrel finishing techniques with the best abrasives. Norton can help you make the right choices.

Among the wide variety of Norton barrel finishing abrasives, bonded TUMBLEX abrasives are made of ALUNDUM* abrasive in four shapes — "T" triangles, "S" spheres, "TP" triangular pins, "RP" round pins. Available in many sizes, they provide fine, uniform finish, short-time cycles, long, even wear and sure savings on many finishing jobs.

Send samples of parts you finish to our Sample Processing Department. We'll barrel finish, return samples and report the methods and abrasives you need to improve quality and cut costs. NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

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NORTON
ABRASIVES

G-380

Making better products . . . to make your products better

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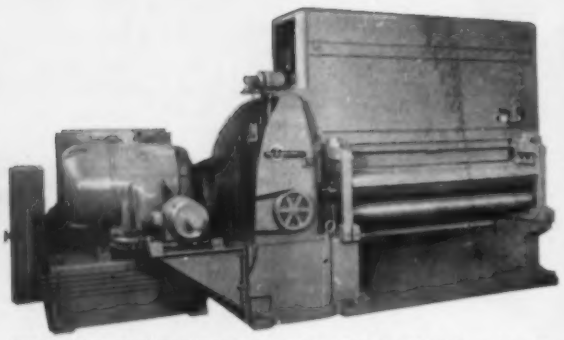
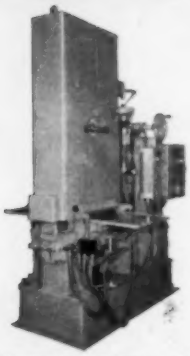
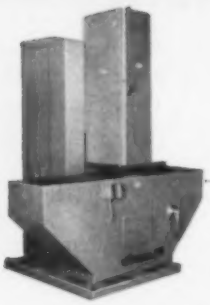


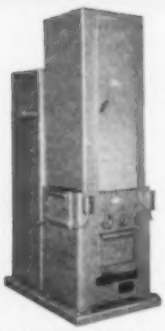
THIS MASSIVE SHEET POLISHING MILL is a pinch-roll type machine to be used for wider flat stock grinding and polishing with belt widths up to 74 inches. A few applications include: prepolishing of stock before forming; polishing stainless steel to standard finishes; upgrading finish of commercial rolled stock; and sizing of various types of sheet and coil stock to engineering tolerances.



THE MODEL FSP-20 MACHINE is a high production, pinch-roll type for polishing of sheet, coil or bar stock. Printed circuits are typical applications for this model. A series of narrow parts can be run side by side on the machine for increased production requirements.



THE MODEL KC-8 MACHINE is a conveyor belt type for high production of miscellaneous shaped parts having flat surfaces to be ground, polished or deburred. Typical applications include parts for tools, hardware, appliances and automobiles.



THE MODEL KP-8 MACHINE is a pinch-roll type for high production of sheets, coil or bar stock. Square or rectangular tubing and extrusions up to 4 in. thick are other common applications. The design of the machine provides a range from heavy stock removal down to fine finishing.

THE MODEL JC-6 MACHINE is a low-cost, high-production grinder and polisher. It is available either as a bench model with conveyor as shown, or the head can be used in conjunction with rotary tables. Multiple head assemblies can be mounted along one common conveyor belt.

ACME the complete line for flat grinding and polishing

These quality abrasive belt grinding and polishing machines are ruggedly built to resist vibrations and produce high-quality finishes. Made in five basic designs, they provide belt widths from 6 to 74 inches. Practically any kind of flat grinding, polishing and deburring operation can be expertly performed on these versatile units. Let Acme polish off your finishing problems. For complete information write:

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Ekco Products Company knows that quality chrome plating gives products permanent brilliance. That's why Ekco uses Mutual® Chromic Acid to plate their Autoyre line of bath, kitchen and closet accessories. Careful control, plating skill plus Mutual Chromic Acid help achieve Ekco's patented Armorized* Chrome-12*, a top quality chrome finish which sells merchandise.

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To learn more about these and other advantages of Mutual Chromic Acid, send coupon for our free booklet, "Chromium Chemicals." Our Technical Service Staff will also be happy to answer your questions.

*Trade Marks owned by Ekco Products Company

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"Peace on Earth . . . Good Will toward Men"

In these times of great progress and prosperity the world is torn by conflicting ideologies and cross purposes.

It is of utmost importance that everyone pause to consider the fullest meaning of "Good Will toward Men" and to bear this in mind not only during the Holiday Season but throughout the entire year.

May your Christmas Season be a joyous one! And may the New Year bring you health, happiness and prosperity!

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R. O. HULL & COMPANY, INC.

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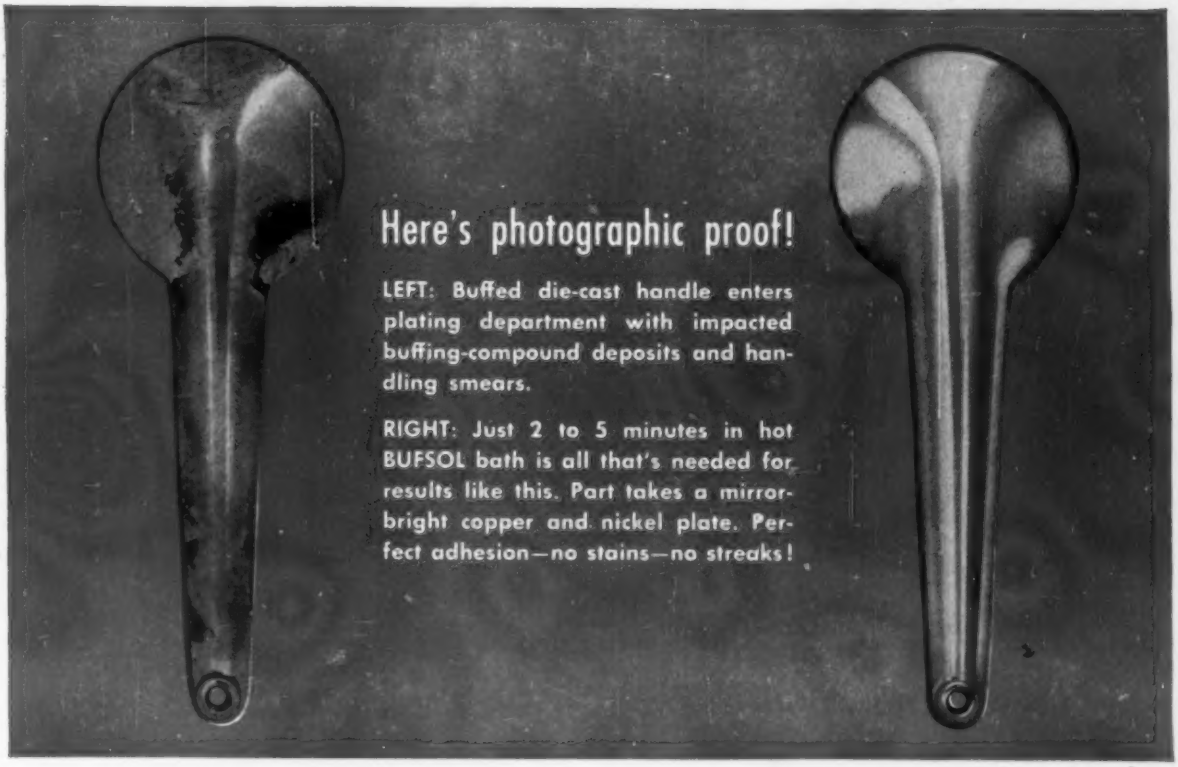
THE RIGHT START . . . A BETTER FINISH

New Wyandotte **BUFSOL**

REMOVES STUBBORN BUFFING COMPOUNDS WITHOUT SOLVENTS


Here's photographic proof!
LEFT: Buffed die-cast handle enters plating department with impacted buffing-compound deposits and handling smears.
RIGHT: Just 2 to 5 minutes in hot BUFSOL bath is all that's needed for results like this. Part takes a mirror-bright copper and nickel plate. Perfect adhesion—no stains—no streaks!

. . . adaptable to every plating cycle

New BUFSOL is fast, safe, effective . . . the perfect solution to your plating department's No. 1 headache—buffing-compound removal. Check these performance features:

Highly effective: BUFSOL assures bright, stain-free, adherent electrodeposits—removes most buffing compounds, tripoli, and rouges—rapidly removes water-dispersible-type compounds.

Concentrated: BUFSOL solutions have long life even when loaded with buffing compound. BUFSOL is completely miscible in water, is used as a dilute solution.

No plating bath contamination: BUFSOL, a liquid detergent concentrate, rinses easily from recesses and damaged rack coatings. Can't interfere with electrocleaner performance!

Safe on metals: BUFSOL will not etch, darken, or attack zinc-base die castings, copper, brass, steel, or aluminum when used at recommended concentrations and temperatures.

Essentially odorless: BUFSOL produces no obnoxious fumes or odors, requires no special ventilation.

For full information on new BUFSOL, and other Wyandotte metal-cleaning products, call in a skilled Wyandotte representative today! *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Nietos, California. Offices in principal cities.*

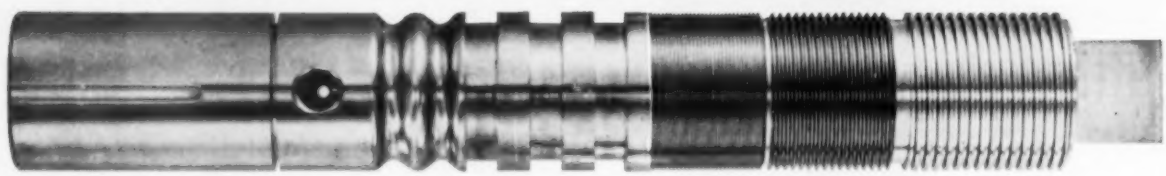
Wyandotte CHEMICALS

J. B. FORD DIVISION

THE BEST IN CHEMICAL PRODUCTS FOR METAL FINISHING

THEY LAUGHED WHEN WE SAT DOWN TO PLATE...

they didn't know about KANIGEN®



This shaft was turned. It was key-slotted, drilled, tapped and shouldered. It was threaded, milled, grooved and chamfered. It was step-bored, with three inside diameters. Who could plate a piece like this all over—inside and out—and expect a uniform coating?

Well, anyone who used KANIGEN® could expect it—and get it. In fact, we made this piece especially to prove it.

The KANIGEN® process for chemical nickel alloy plating produces a uniform thickness of coating, regardless of the contours of a part. This uniformity permits full machining operations prior to coating, with no subsequent cleanup.

KANIGEN® offers corrosion resistance equal or superior to that provided by wrought or electrolytic nickel.

For complete technical details write or call your nearest General American office. Ask for Kanigen Bulletin No. 258. You'll find that with plating as in so many other industrial areas, *it pays to plan with General American.*

Kanigen Division

GENERAL AMERICAN TRANSPORTATION CORPORATION

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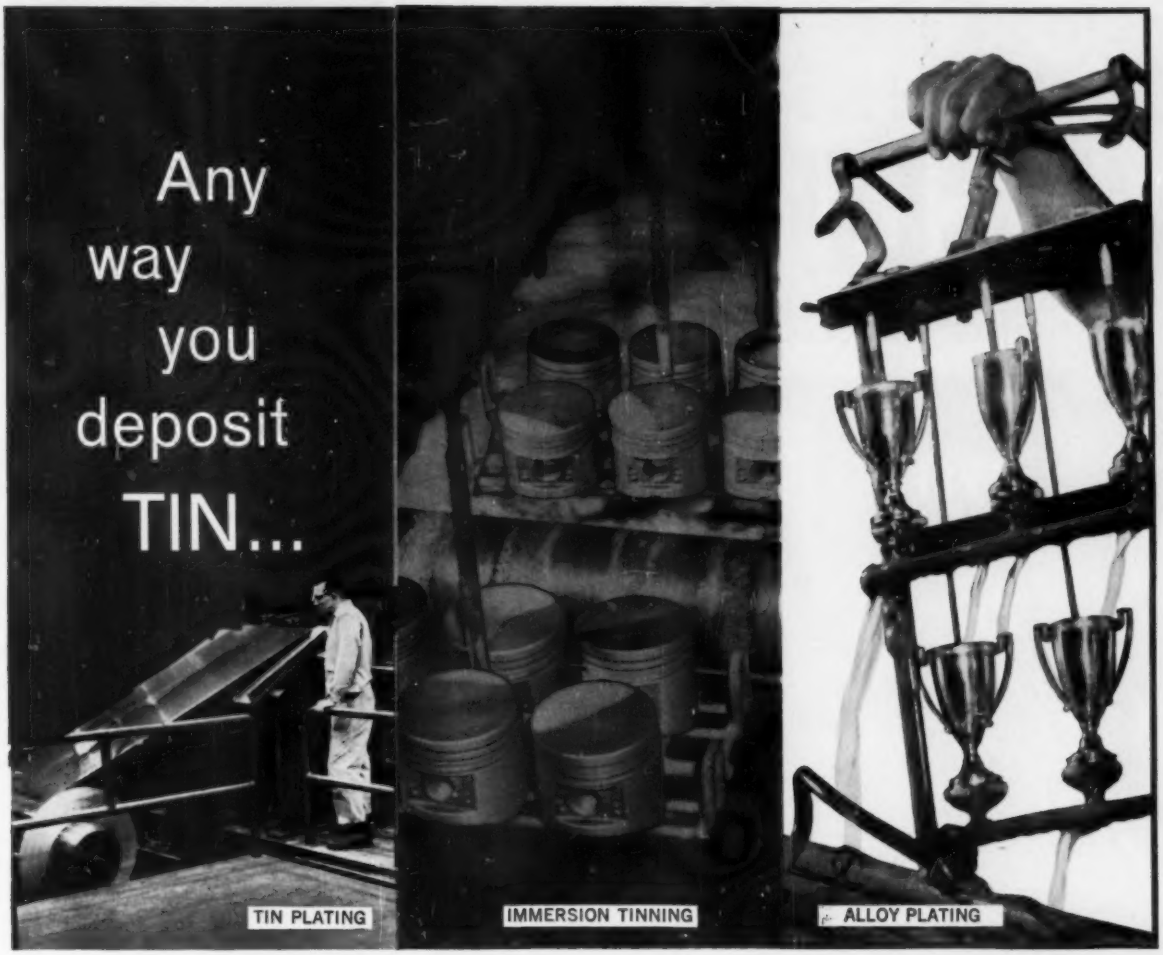

M&T can be a big help to you

A *choice* of stannate compounds . . . a *variety* of processes . . . and long-time practical *plating experience*...only from Metal & Thermit can you count on such rounded out and complete service.

A leading supplier of sodium stannate, M&T is also the country's *sole* producer of potassium stannate. With these and other tin chemicals, M&T can recommend the process that meets your requirements best.

If you're plating tin, you may want the extra advantages of M&T HIGH SPEED TIN, which uses a potassium stannate solution and offers more stability, efficiency and higher speed compared to sodium stannate. M&T "high speed" Anodes for this or sodium stannate solutions further reduce costs and simplify control, permitting current densities about double those for ordinary tin anodes.

For alloy plating, there are not only the practical and easy-to-control M&T TIN ZINC and M&T TIN NICKEL processes . . . but also M&T BRONZE which is widely used to replace copper as an undercoat, and as a gleaming, gold-colored final finish.

In tinning of aluminum alloy, copper and copper base alloys, the job is readily and uniformly done by immersion using solutions with M&T Potassium Stannate.

Whether you're using stannates now, or would like to put them to work for you, it pays to call in the company that has most to offer you in this field.

M&T **plating products**

METAL & THERMIT CORPORATION
General Offices: Rahway, New Jersey
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NEW EXCLUSIVE!

ATLANTIC GREASELESS COMPOUNDS

WITH K-134

The miracle additive newly discovered and developed by Atlantic's research laboratories

- REDUCES APPLICATION TIME
- ADHERES BETTER TO BUFFING WHEELS
- CUTS DOWN COSTLY WASTE
- ASSURES UNIFORM SATIN FINISH

Order NEW Atlantic Greaseless Compounds with Additive K-134 for faster, more economical buffing and polishing; and for longer-lasting, higher quality finish of metals, plastics and wood.

Devoted exclusively to producing unexcelled greaseless compounds, Atlantic maintains constant research to continually improve its products. The dependable uniformity of Atlantic compounds is assured by the highest grade ingredients and efficient quality control. Technical assistance and data available on request.

THE ATLANTIC COMPOUND CO.

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SONOGEN®

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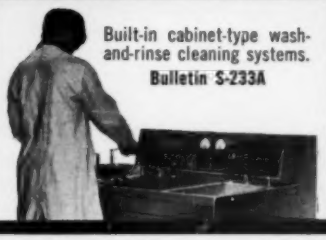
½-gallon and larger benchtop models, and (illustrated) 5- and 12-gallon self-contained rollaround units. **Bulletin S-509, S-217B**



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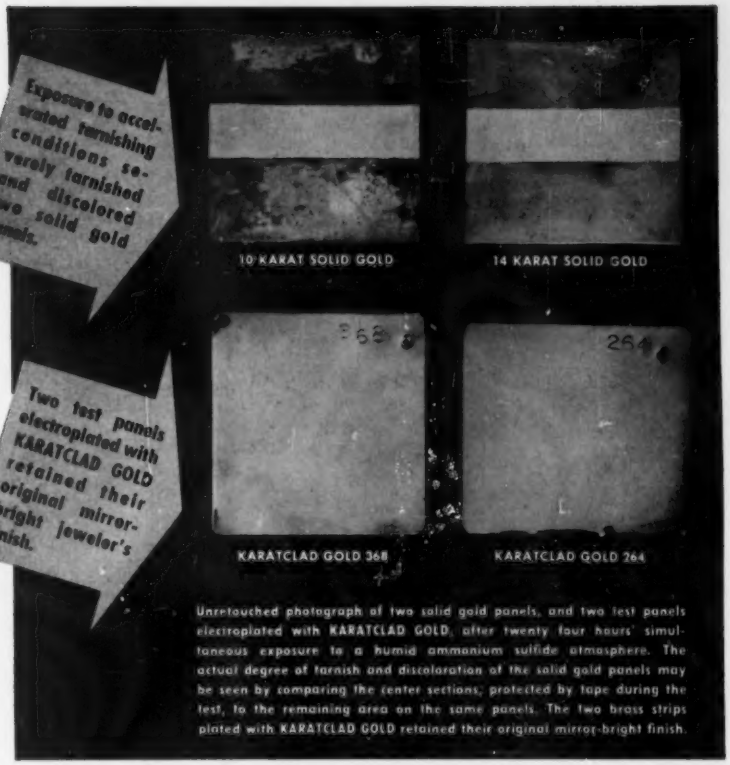
KARATCLAD® outshines solid gold in tarnish test


Exposure to accelerated tarnishing conditions severely tarnished and discolored two solid gold panels.
Two test panels electroplated with KARATCLAD GOLD retained their original mirror-bright jeweler's finish.
10 KARAT SOLID GOLD
14 KARAT SOLID GOLD
KARATCLAD GOLD 368
KARATCLAD GOLD 264

Unretouched photograph of two solid gold panels, and two test panels electroplated with KARATCLAD GOLD, after twenty four hours' simultaneous exposure to a humid ammonium sulfide atmosphere. The actual degree of tarnish and discoloration of the solid gold panels may be seen by comparing the center sections, protected by tape during the test, to the remaining area on the same panels. The two brass strips plated with KARATCLAD GOLD retained their original mirror-bright finish.

The solid gold panels, one of 14 Karat the other of 10 Karat, were placed in a humidity chamber containing a pool of 5% ammonium sulfide solution, together with two brass panels electroplated with KARATCLAD GOLD. Exposure for twenty four hours at room temperature produced the results graphically demonstrated in the unretouched photograph. The actual degree of tarnish and discoloration on the solid gold panels may be seen by comparing the middle sections, protected by tape during the test, with the remaining area of the same panels.

The results of this simple experiment are important in the marketing of jewelry, on which low alloy solid gold or clad materials are used. Such products often tarnish, become dull and unattractive while on display in the jeweler's showcase. Not only does KARATCLAD GOLD retain the all important "eye-appeal" so vital to the sale of jewelry products, but its dense, hard surface has excellent resistance to *all kinds* of atmospheric and abrasive conditions. Thus the better wearing qualities and long-lasting beauty of KARATCLAD GOLD PLATE make for profitable repeat sales from satisfied customers.

What's more, the KARATCLAD GOLD PLATING PROCESSES give you the **colors** your customers want—with no variations from batch to batch—and a mirror-bright **jeweler's finish in any thickness right from the bath.** And, you get these sales-increasing advantages at far less cost than is possible with most other gold materials available to the industry.

KARATCLAD GOLD ELECTROPLATE also permits practical and *economical* compliance with the new applicable Federal Trade Commission Rules. The minimum seven-millionths thickness required by the mark "Gold Electroplate", when produced with KARATCLAD, provides **all** the previously mentioned advantages—**without the extra costs and bother of lacquering.**

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We'd be happy to plate samples of your own products with KARATCLAD GOLD—to your specifications—so you can evaluate the merits of this exciting development first-hand. Write, wire or 'phone...we'll make all the necessary arrangements.

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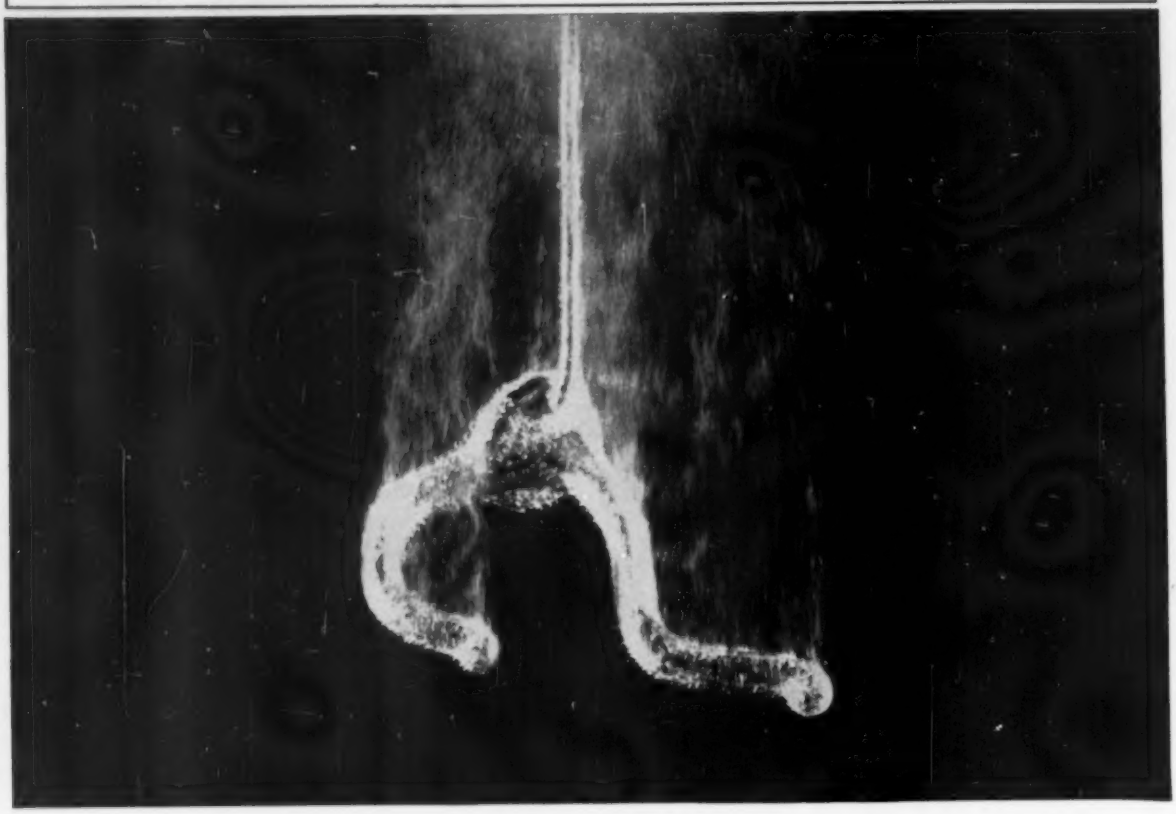

Improved electrocleaning of recesses and low current density areas

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Despite careful racking and well-planned production, deep recesses and places of normally low current density on intricately shaped parts are always trouble spots.

Diversey electrocleaners were specially fortified with exceptionally high wetting and emulsifying powers to do an effective job at those "problem places." This chemical cleaning supplements high current carrying capacities to give more efficient cleaning in a shorter time. Work emerges waterbreak-free and smut-free, ready for subsequent baths.

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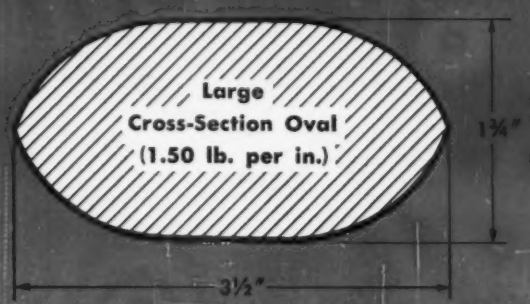
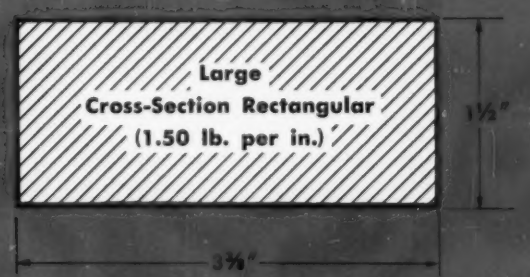
Besplate NICKEL ANODES..
large cross-section ovals and rectangulars

Oval Anodes



Rectangular Anodes



For the past 30 years, McGean Besplate Nickel Anodes have been produced in various shapes and sizes to meet customer requirements. The large cross-section anodes are 30% heavier than regular oval anodes and have the same identical composition. They are also 50% heavier than the standard Rolled Carbon Nickel Anodes.

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5. The large cross-section nickel anodes are chemically cleaned and packaged in the same fine manner as all McGean anodes.
6. The McGean foundry is equipped to process scrap nickel anodes into large cross-section ovals and rectangulars.

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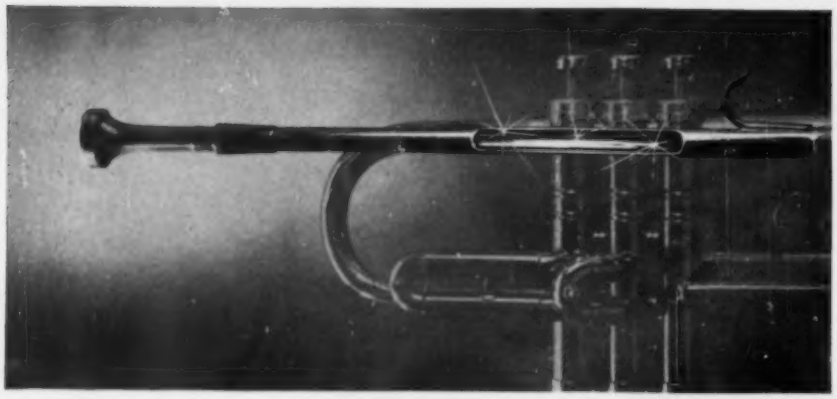
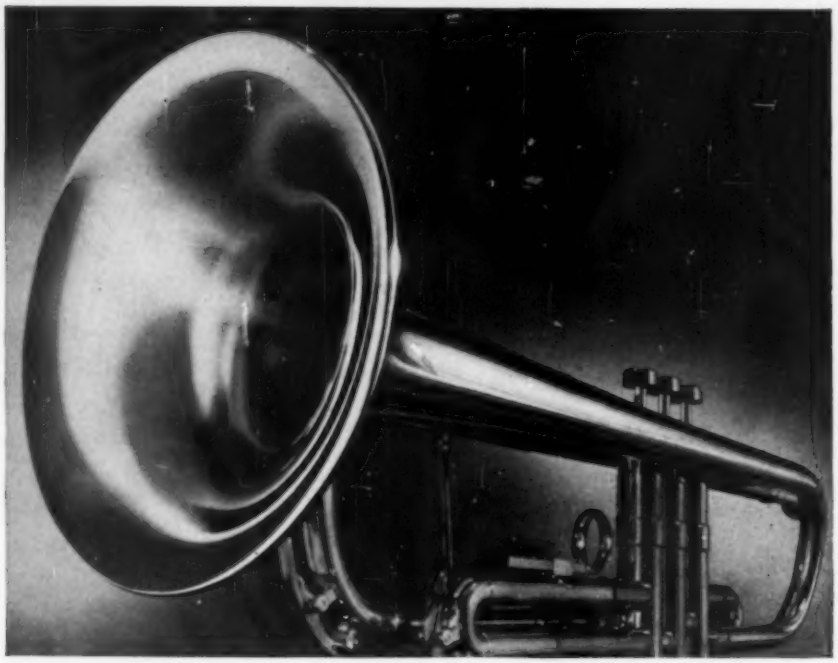
Conn produces the "heart" of good tone quality by electrodeposition, with "Plus-4" Copper Anodes



CONN ELECTRO-D TONE CHAMBER (mouthpipe) cut away to illustrate the "micro finish" interior surface. Chamber and mouthpiece receptacle are formed in one piece by electrodeposition; previously the two pieces were soldered together. (Patent pending.)



ELECTRO-D BELL, also formed by electrodeposition.

In a cornet or trumpet, good tone and easy playing depend largely on the inside shape and finish of the tone chamber (mouthpipe).

Aiming at perfection, C. G. Conn, Ltd., famous maker of band instruments, turned to forming these critical parts by electrodeposition of copper on stainless-steel mandrels. The deposited copper conforms perfectly to the precision mandrel—providing the exact taper and dimensions every time. It also gives the smooth mirrorlike inside surface that prevents acoustical losses. Even minor irregularities caused by forming sheet metal or tube can muffle, distort, or rattle the tone.

Using "Plus-4" Phosphorized Copper Anodes in its acid-copper electroplating tanks, Conn has found it gets the smooth, dense deposit it needs. The build-up of metal is fast and uniform, as "Plus-4" Anodes' extra "throwing power" is of particular value with the tubular shapes. There are few nodules, which minimizes finishing of the outside surface. And tank maintenance is simplified.

Conn also forms the bells used in cornets, trumpets, and trombones electrolytically. This gives still further control in the precision of the entire inside tone columns of its instruments—for increased resonance and live, powerful tone.

WRITE FOR INFORMATION on how you can obtain a test quantity of "Plus-4" Anodes to supply one tank. Address: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Toronto 14, Ontario.

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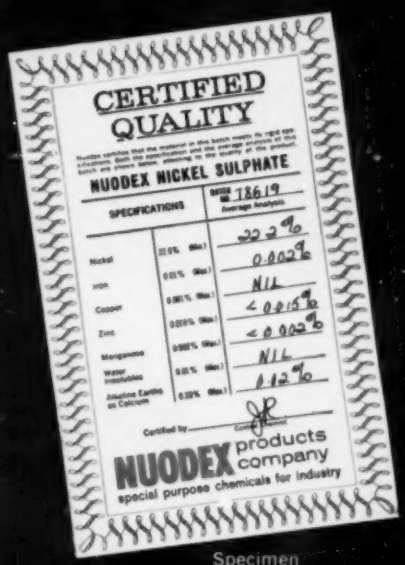

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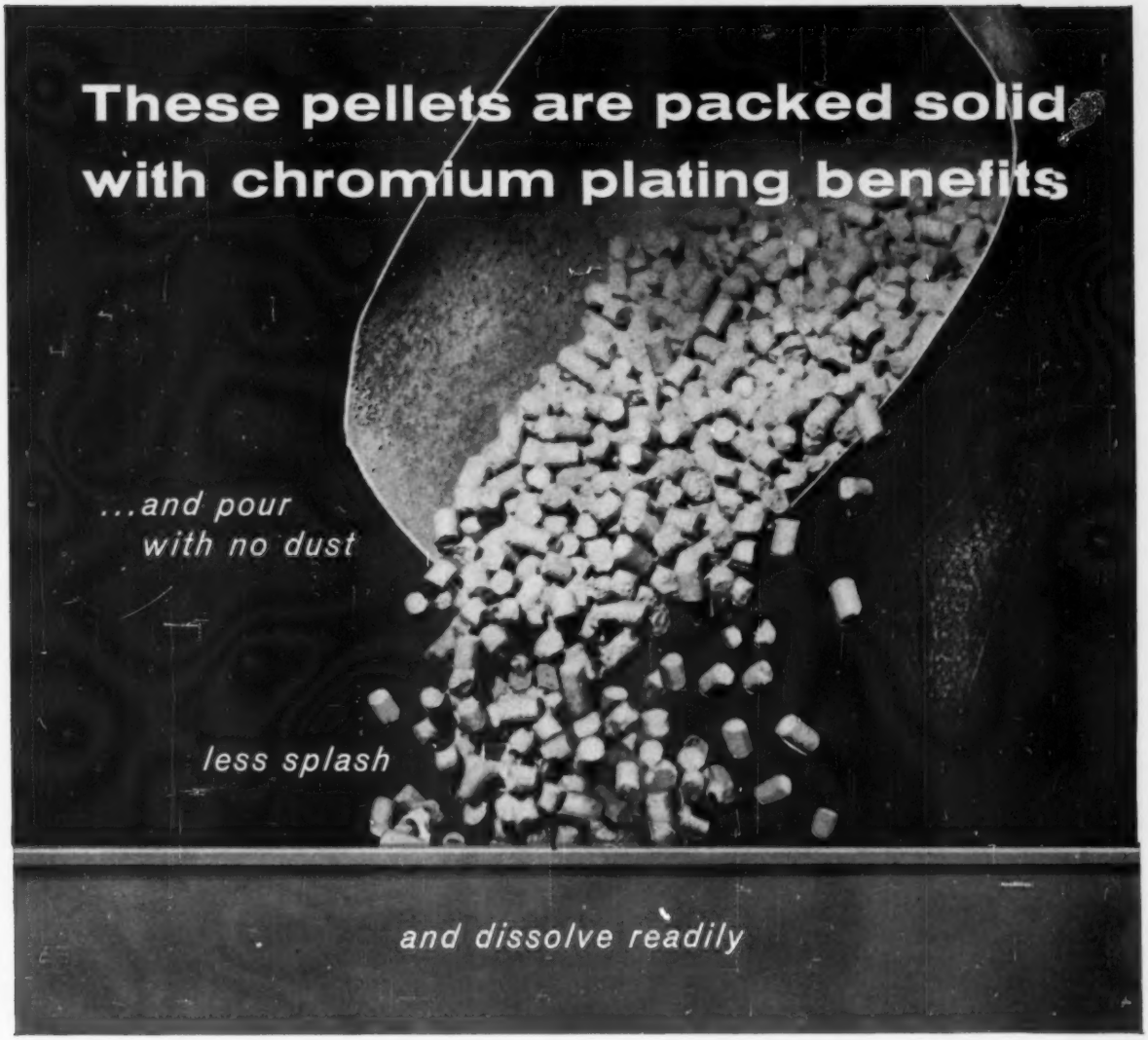

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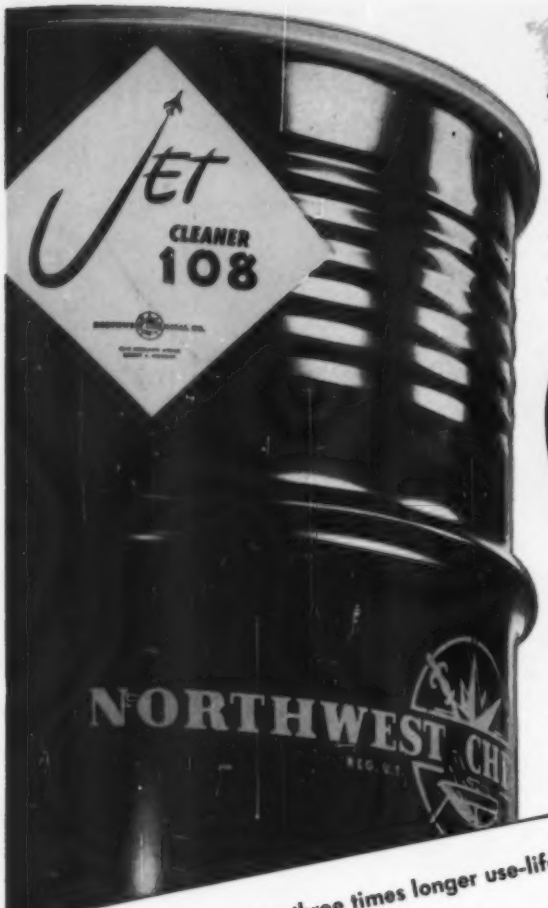

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by Ben P. Sax

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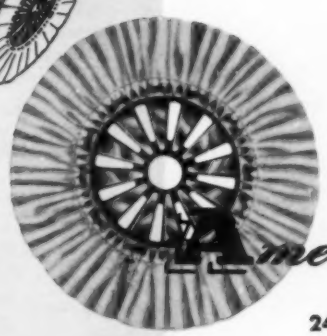

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Corrosion Technology
Leonard Hill Technical Group
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15 Udney Park Rd.
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AWAITED internationally, the book TECHNICAL PROCEEDINGS (Golden Jubilee Edition) has just been completed, and copies will soon be speeding to all corners of the world to accommodate members of the American Electroplaters' Society (AES), its exclusive publisher. A limited number of copies are available for sale to AES non-members.

The unique book contains the full text of each of the 43 technical papers on electroplating, metal finishing, organic coating and allied arts by experts of nine countries, including the United States, England, Canada, Australia, France, Germany, Holland, India and Italy, delivered before the Fifth International Conference on Electrodeposition and Metal Finishing, educational sessions element of the AES's Golden Jubilee Convention held in Detroit, Michigan, June 15–19, 1959.

Embodying, too, the charts, diagrams graphs, tables and other illustrations of each of the 43 published papers, *the book also includes the transcript of the discussion that attended the delivery of each paper.* A full list of the papers published in this voluminous treasure chest of knowledge appears on the facing page of this announcement.

Spanning some 400 pages (by far the largest annual TECHNICAL PROCEEDINGS ever published by the AES in its half-century lifetime), this 1959 edition also includes, among other data, a day-to-day log of the Golden Jubilee Convention; a section on the AES Scientific Achievement Award and on other AES technical and scientific awards and honors bestowed at the Golden Jubilee Convention; a full listing of the Boards and Standing and Special Committees that served the AES during its Fiftieth Anniversary year, and a complete AES Branch Directory.

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A LIMITED extra quantity of the book has been printed to meet the sizable interest shown in it by AES non-members internationally. Orders for copies of the book are now invited from AES non-members, and will be accepted on strictly a "first come-first served" basis so long as that extra supply lasts. The book is unavailable elsewhere.

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INTERNATIONAL CONFERENCE: ITS AES HALF-CENTURY SETTING

DRAMATIC and fitting climax of its year-long FIFTIETH ANNIVERSARY observance, American Electroplaters' Society, Inc. (AES) conducted its unique Golden Jubilee Convention and Industrial Finishing Exposition, including the concurrent Fifth International Conference on Electrodeposition and Metal Finishing, in Detroit, Michigan, June 15-19, 1959.

GREETED by the President of the United States, the AES was welcomed to Michigan and Detroit by Governor G. Mennen Williams. The entire week of the AES's Convention, Exposition and International Conference was proclaimed by Detroit's Mayor as "AES GOLDEN JUBILEE WEEK IN DETROIT."

AS the Fifth International Conference on Electrodeposition and Metal Finishing, the Golden Jubilee Convention's educational sessions numbered eleven. Experts from nine countries, including the United States, England, Canada, Australia, France, Germany, Holland, India and Italy, presented 43 technical and scientific papers enriching knowledge in electroplating, metal finishing and allied arts. High spot of the sessions was the first "William Blum Lecture" that was delivered by the eminent Dr. William Blum, first winner of the AES Scientific Achievement Award, the Society's highest honor.

UNDER the supervision of the AES's Editorial Board, in collaboration with the International Council on Electrodeposition and Metal Finishing, the International Conference was planned for the AES by AES Past President Walter L. Pinner, Chairman of the International Council. His Committee included Dr. T. P. Hoar, Dr. Simon Wernick, A. W. Wallbank, R. A. F. Hammond and George Gardam of England and Myron B. Diggin, Dr. Walter R. Meyer and Dr. Richard B. Saltonstall of the United States.

OPENING SESSION OF THE FIFTH INTERNATIONAL CONFERENCE ON ELECTRODEPOSITION AND METAL FINISHING

(1) Chairman Walter L. Pinner extending official welcome. Dr. William Blum, AES Scientific Award winner, seated. (2) Crowded auditorium at the first session. (3) Session Chairman T. P. Hoar introducing Dr. Blum, who delivered the first William Blum Lecture.

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To all our faithful old friends . . . cherished new friends . . .

all whose friendship we hope to earn in the coming year—

sincere wishes for a Merry Christmas and a Happy New Year!

Fig. 1

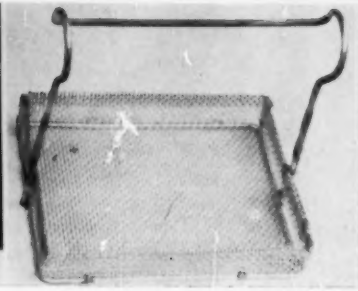

Fig. 2

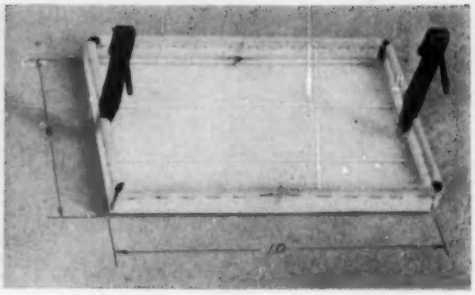

Fig. 3

AUTOMATIC FLAT BASKET PLATING

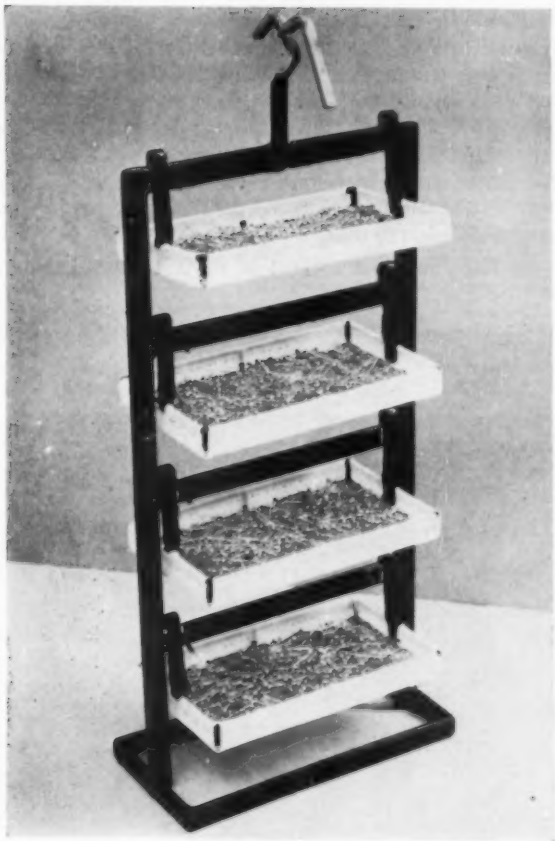

Fig. 4

by G. J. MAROTTA*

WITH THE INCEPTION of manufacture of deposited carbon resistors at the Merrimack Valley Works of the Western Electric Co., Inc., early in 1958, certain difficulties were encountered which were attributable directly to the poor quality of the copper-tin electroplated finish on the ferrule and lead assemblies. These are the parts shown in the Fig. 1. This condition prompted an investigation of the methods employed in applying the finish.

To plate 500,000 of these parts per day by racking individually would be excessively costly. Bulk plating in tumbling barrels presented several problems, especially bending of the leads which could not be permitted on components designed for automatic assembly. The ensuing search culminated in the development of a new type flat electroplating basket, a basket which overcame many of the short-comings inherent in the conventional design.

Fig. 2 depicts a flat plating basket typical of the design commonly employed in the plating of small fragile parts of this nature. It is constructed entirely of electrically conductive materials, usually consisting of a brass framework covered with a bronze wire mesh. Several variations of the basic design are commercially available, but are equally unsatisfactory in the results obtained. Parts plated in this container are

*Finishing Engineer, Merrimack Valley Works, Western Electric Company, Inc., North Andover, Massachusetts.

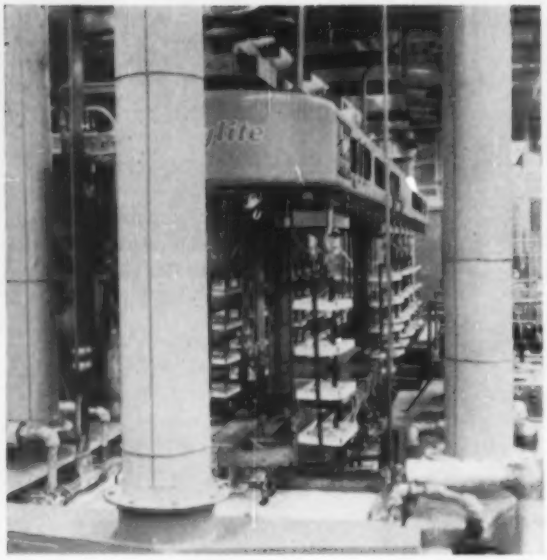

Fig. 5

shielded by the basket which itself plates along with the parts it contains. The basket rapidly builds up heavy deposits of plated metal, as much as a pound per shift, and, in a few days, most openings of the wire mesh are completely sealed. Salvage of the basket is impractical and the costs of wasted metal deposited on the baskets and basket replacement or repair is excessive. In order to deposit any metal at all on the parts it is necessary to remove the parts several times during the plating operation to turn the parts over and expose those surfaces which have been in contact with the wire mesh. As well as being cumbersome to perform, wasteful of plating solutions, hazardous to the operator and detrimental to productive operation, this procedure results in the bending of a high percentage of leads. The bending is due mainly to the tendency of the 0.032 in. diameter lead wires to protrude through the openings in the wire mesh bottoms of the plating baskets, which difficulty is not readily overcome. The mesh openings must be of a fairly large size so as not to close up with plated metal accumulation in a short period of use. Any leads which do protrude also receive a much higher concentration of plating current causing many to build up to a diameter too large to use.

A detailed investigation disclosed that a high percentage of parts possessed extremely low plate thickness, some as low as 3 to 5 msi, average weight of deposited tin, which was the cause of poor solderability and tarnished, blackened leads. The using shop was faced with the necessity of hand hot solder dipping individually each lead after assembly to a resistor in order to meet the solderability requirements of Bell Telephone Laboratories specification GA-9122* which was imposed on the final product. In addition, a high percentage of fall-out due to bent leads was experienced at the final assembly operations. These inherent weaknesses of the conventional design basket had to be overcome as the output of the assembly shop was seriously hampered due to these defects.

Initial work in developing a better method for plating the ferrules disclosed that barrel plating was not feasible due to the tendency of these parts to "rope" together. The bending of leads, as mentioned earlier, was also intolerable. Although not a new method, flat basket plating was decided upon as the only practicable method of plating parts of this type. Development was undertaken to produce an improved basket which could be adapted to the fully automatic plating machine, this being the only still tank copper-tin plating facility available at Merrimack Valley. Fig. 3 shows the design which was finalized after several weeks of experimentation. The basic idea was to substitute a non-conducting covering for the brass wire mesh to eliminate shielding of the parts during plating.

Starting with a basket made of chicken wire covered with plastic window screening, which was fairly successful, the engineers arrived at the highly satisfactory design shown in Fig. 3. This fabrication consists of a framework of 300 series stainless steel wire which is PVC plastisol coated all over excepting the two longitudinal conductors, which carry current to the work load, and the outer framework which assists in equalizing current distribution throughout the basket load by acting as a peripheral shield or thief.

Stainless steel was selected as the material resistant to

*Requires that rosin fluxed leads coated with 60/40 solder at 450F show no more than 5 per cent of surface with pin holes under 10 power glass.

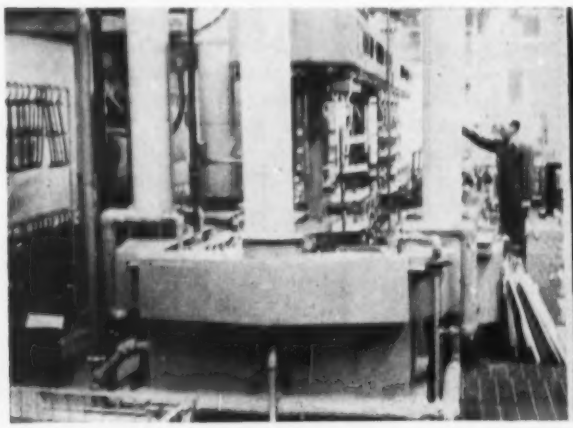

Fig. 6

Fig. 7

Fig. 8

attack by all solutions used in plating and easily stripped of built-up plating in nitric acid to which a small amount of hydrochloric acid is added. The underside of the two hooks are bared to make contact with the cross bar of the carrier rack which conducts plating current to the baskets. The cross bars are also made of stainless steel for ease of stripping where exposed for contact with the basket hooks. The basket covering is a woven fabric of monofilament high temperature polyethylene which is impervious to all materials used in the plating process as well as being a non-conductor of electrical current. This material, it was learned from the first prototypes, has a residual shrinkage of 25 per cent which requires preshrinking in boiling water before cutting the required pattern. The ragged ends of plastic filaments are fused with a soldering iron to prevent unraveling. Stainless steel staples secure the covering to the basket framework. Fig. 4 shows these baskets mounted on a carrier rack which is plastisol coated, except where making contact with the basket hooks.

The fabric covering does not act as an electrical shield, yet is woven tightly enough to keep the wire leads from protruding and becoming overplated while the weave is open enough to allow for good drainage. The leads are virtually as straight after plating as they are before plating. Turning and agitating the parts during plating is not necessary for complete, even coverage, nor are auxiliary anodes required. The parts are in contact with a plastic membrane not a conducting wire mesh which acts as a thief or robber. Fig. 5 depicts the baskets and carriers in use on the full automatic copper-tin plating machine.* Fig. 6 shows another view of the baskets and the automatic plating machine.

The baskets are periodically indexed through the cleaning and plating solutions by the automatic plating conveyor causing fresh solution to circulate through the baskets and around the parts. The excellent covering power of the alkaline tin plating solution will permit plating between two wire leads at the point of contact as long as solution is circulated between them.

As manual dipping is completely eliminated by this method, two No. 32 grade† operators, such as the one shown in Fig. 7 are all that are required to load and unload the baskets and the machine. In Fig. 7 the operator is weighing a predetermined amount of parts, which she will load into one basket. She then places four baskets on one rack. Fig. 8 shows the same operator as she is loading and unloading the plating machine conveyor. One other direct labor operator is required.

Fig. 10 shows the parts being lowered into the anodic cleaning solution. Fig. 11 catches the same rack lowered further into the solution and shows how the basket is flooded while rapidly being submerged. Fig. 12 is a view of the baskets in the acid dip solution. Fig. 13 is taken from overhead the conveyor, which is in the up position, and the baskets are those being elevated from the copper plating solution. The baskets in the rear remain in the tank. Fig. 14 shows the parts after copper plating being lifted from the copper plating tank with plating solution draining off. In Fig. 15 these baskets are

*Udylite Jr., manufactured by The Udylite Corp., Detroit, Michigan.

†Lowest level of skill and experience required in Western Electric Co. labor grading system.

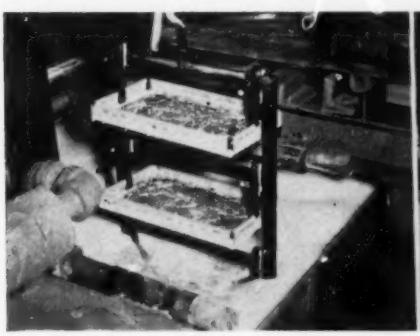

Fig. 10

Fig. 11

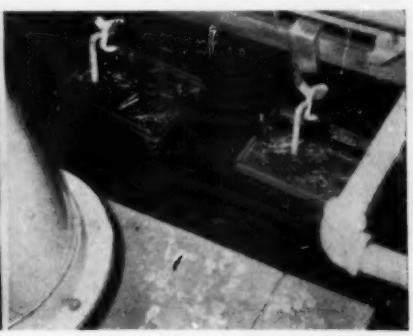

Fig. 12

Fig. 13

indexing forward to the tin plating operation. The baskets are in the tin plating solution in Fig. 16, with one carrier just entering.

Fig. 17 is a fairly good representation of the amount of drag-out which is to be expected in an automatic operation of this type. Fig. 18 shows an operator emptying a basket of plated ferrules into a tray. This pleasing scene is re-enacted about 750 times each day that these parts are plated. Fig. 19 is a closeup of the adapter made for measuring average plate thickness on the wire leads by utilizing the Kocour electrolytic stripping thickness tester and its WT attachment. This unit is employed by both the operating personnel and the Inspection Organization to control the process and inspect for plate thickness. Microscopic measurement has not been required for our application.

A complement of baskets and racks was purchased for about $1,750.00. With 800 parts per basket and 4 baskets per rack, and a plating machine output of one rack every two minutes, the daily production exceeds 600,000 pieces per eight-hour shift.

The results have been most gratifying as shown in Fig. 20. The RH section of the chart shows the range of plate thickness to be expected from parts plated in each type of basket. The LH curves show the distribution of plating thickness to be expected from a random sampling of a day's run of work in each of the two types of plating basket. The variation of plate thickness in the new design basket is no greater than that experienced in barrel plating.

Fig. 21 is self-explanatory as it pictorially represents the experience with the new basket at the Merrimack Valley Works as its effectiveness is reflected in increased output per man-hour, reduction in the number of leads bent in plating, elimination of rejects due to defective solderability and reduction in maintenance and repair costs of the plating basket itself.

The new method of plating delicate parts has been applied to several other parts at Merrimack Valley with an equal degree of success. Parts as small and fragile as 0.005 in. diameter headed leads for quartz crystals have been successfully plated in these baskets. The baskets have been used to deposit other metals successfully, including gold, silver and nickel. Patent investigations indicate certain features of this design may be patentable and application has been made.

ACKNOWLEDGMENT

Acknowledgment is hereby made of the valuable contributions to this development by my associates Messrs. A. R. Swenson and L. S. Ray.

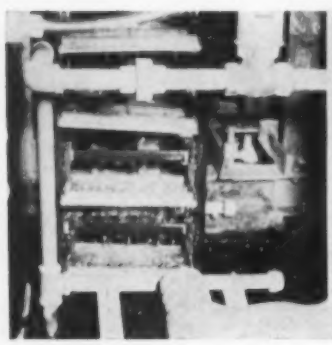

Fig. 14

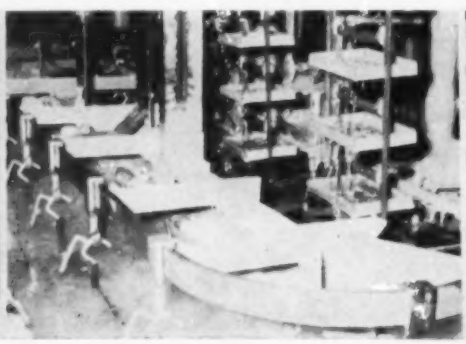

Fig. 15

Fig. 16

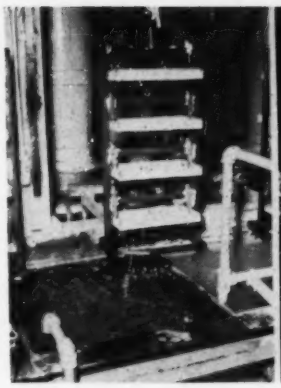

Fig. 17

Fig. 18

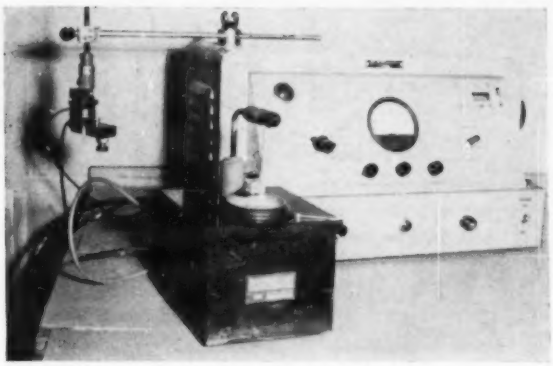

Fig. 19

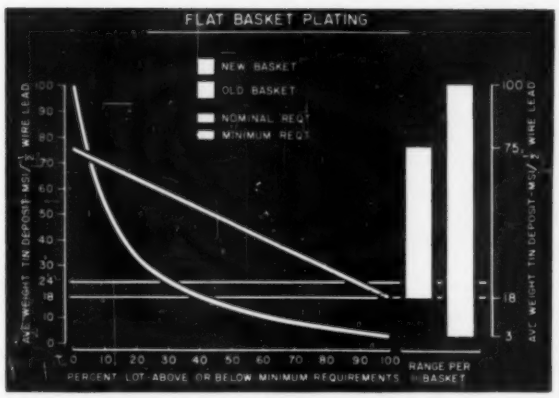

Fig .20

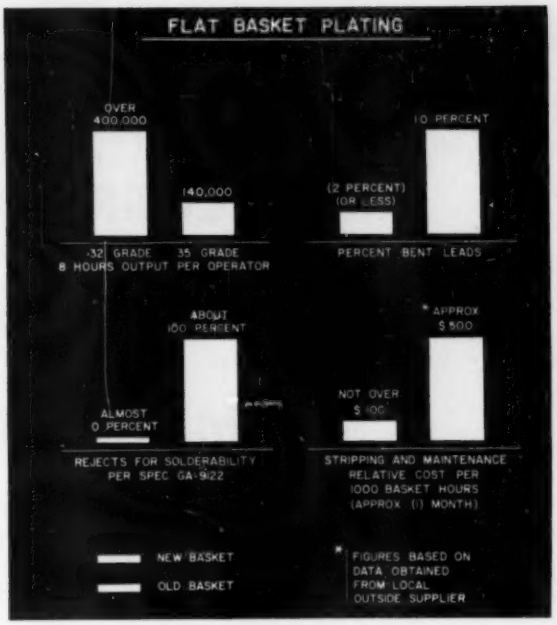
FLAT BASKET PLATING
OVER 400,000
140,000
32 GRADE 8 HOURS OUTPUT PER OPERATOR
35 GRADE PER OPERATOR
10 PERCENT
(2 PERCENT) (OR LESS)
PERCENT BENT LEADS
ABOUT 100 PERCENT
ALMOST 0 PERCENT
REJECTS FOR SOLDERABILITY PER SPEC GA-922
* APPROX $ 500
NOT OVER $ 100
STRIPPING AND MAINTENANCE RELATIVE COST PER 1000 BASKET HOURS (APPROX (1) MONTH)
NEW BASKET
OLD BASKET
* FIGURES BASED ON DATA OBTAINED FROM LOCAL OUTSIDE SUPPLIER

Fig. 21

George J. Marotta received his Bachelor's degree in mechanical engineering from Tufts University in 1945. Upon completion of a tour of duty with the U. S. Navy as an engineering officer, he joined the A. S. Campbell Co. Inc. as a finishing methods engineer. In 1954, he became superintendent of metal finishing for the Insuline Corporation of America, in Manchester, New Hampshire. In 1956, he rejoined the Campbell Co. in East Boston and in 1957 accepted the position of finishing engineer with the Western Electric Co., Inc., of No. Andover, Mass. He is an active member of the Boston Branch of the AES having served as librarian and currently holds the office of second vice president and is chairman of the Educational Program of the 1961 AES Convention in Boston.

CORROSION DATA FOR CHEMICAL NICKEL PLATING

By J. ROBERT SPRAUL*

WITHIN THE PAST five years, chemical nickel plating has become commercially available on a broad scale. It has assumed increasing importance as a coating material having several very unique properties. The purpose of this paper is to give corrosion data for chemical nickel plating versus a wide variety of corrosive agents.

The basic reaction upon which chemical nickel plating depends was discovered by Wurtz in 1846.[1] He believed that the reaction between a nickel salt and the hypophosphite ion would produce metallic nickel. In 1911, P. Bretean determined that the deposit is a nickel-phosphorus alloy, with the phosphorus content mainly a function of *p*H. Little further investigation of this reaction was made until shortly after World War II when Brenner and Riddell published their papers and patent on chemical nickel plating.[2–4] After this publication by the National Bureau of Standards, General American Transportation Corporation undertook the commercial development of this process.

Some of the issued patents covering the most important contributions are listed in the references.[5–16]

Basically, they disclose bath compositions allowing optimum deposition rate and quality at the lowest cost; means to obtain a high degree of solution stability over a long period of time; equipment and operating methods for large scale industrial production.

PRETREATMENT PROCEDURES

Chemical nickel plating, like all protective coatings, requires a clean surface. It is of even greater importance with this type of deposition since it is a catalytic process. Pretreatment procedures yielding clean surfaces free of dirt, grease and rust are required not only for good adhesion but for good corrosion resistance. For all of the tests described in this report, a double cycle soak cleaning has been used as described below:

1. Vapor degrease, 5 minutes.
2. Soak clean, 95C for 30 minutes.
3. Rinse, 45C for 2 minutes.
4. Pickle, 2:1 HCl + Addition Agent, 25C for 10 minutes.
5. Rinse, 45C for 2 minutes.
6. Soak clean, 95C for 30 minutes.
7. Rinse, 45C for 2 minutes.
8. Pickle: 2:1 HCl, 25C for 10 minutes.
9. Rinse, 45C for 1 minute.

Practically all of the tests described in Table I were conducted on polished 1010 steel. The panels were 2½ in. wide by 6 in. long by ⅛ in. thick. They were polished with 90, 100, and 150 grit dry followed by 150 grit greased before plating (microinch RMS finish of panels: 6.5–8.5 across width and 2–4 lengthwise).

BATH COMPOSITION

Variations in bath composition will cause changes in the corrosion resistance due to some changes in the plating composition. For example, the phosphorus content of the plating can be varied by operating at different *p*H values. The presence of impurities (e.g. >200 ppm Ca^{++}) or the introduction of certain additives to the bath will decrease the adhesion of the plating or may cause greater internal strains which often lead to poorer corrosion resistance. Other operational and compositional variations can have some influence on the corrosion protection offered by the plating.

All of the tests reported in Table I were performed on plating produced by the process* developed by General American Transportation Corporation.[17]

The standard plating bath of the process used for all cor-

*Acting Manager, Corporate Research and Development, Rheem Manufacturing Company, Southgate, California.

*Kanigen, registered trade mark of General American Transportation Corporation

TABLE I

CORROSION DATA ON CHEMICAL NICKEL PLATED PANELS

Commodity	Test Temp., °F	Aeration	Immersion	Test Time (Weeks)	Corrosion Rate (MPY)	Heat Treatment	Comments	Recommendation
Acetic Acid, 5%	Room	No	Total	4	0.79	None	Panels black Solution green	NR
Acetic Acid, 5%	Room	Yes	Total	4	5.95	None	Panels black Solution green	NR
Acetic Acid, 5%	Room	Yes	Total	20	0.845	Yes		NR
Acetic Acid, 10%	Room	Yes	Total	8	1.13	Yes	Panels tarnished	NR
Acetic Acid, 50%	Room	Yes	Total	8	Attack on base metal	Yes		NR
Acetic Acid, 50%	Room	No	Total	16	Attack on base metal	Yes		NR
Acetic Acid, Glacial	Room	Yes	Total	8	Attack on base metal	Yes		NR
Acetic Acid, Glacial	Room	No	Total	16	Attack on base metal	Yes		NR
Acetone	Room	No	Total	16	0.003	None		R
Acetylene Bromide	Room	No	Total	3	None	None		R
Acetylene Bromide + 1% water	Room	No	Total	3	None	None		R
Acrylonitrile	150	Yes	Total	3	0.016	None		R
Acrylonitrile	150	Yes	Total	3	0.013	Yes		R
Allyl Chloride	Room	No	Total	24	0.039	None		R
Alum	150	Yes	Total	3	Severe	None	Solution turned green	NR
Alum	150	Yes	Total	3	Severe	Yes	Solution turned green	NR
Aluminum Sulfate sat'd. soln.	Room	Yes	Total	4	Attack on base metal	No		NR
Ammoniated Ammonium Nitrate	Room	No	Panel in vapors	16	0.258	No		NR
Ammoniated Ammonium Nitrate	Room	No	Total	16	0.31	No		NR
Ammoniated Ammonium Nitrate	Room	No	Total	12	0.031	Yes		—
Ammoniated Ammonium Nitrate	Room	No	Panel in vapors	16	0.28	Yes		NR
Ammonium Chloride Solution	Room	No	Total	16	0.230	No		NR
Ammonium Hydroxide, 30% NH_3	Room	No	Total	4	2.3	No	Solution turned blue	NR
	Room	No	Total	29	Severe	Yes	Solution turned blue	NR
	Room	No	Partial	24	Severe	Yes	Solution turned blue	NR
Ammonium Nitrate, 63%	Room	No	Partial	24	Severe	Yes		NR
	Room	No	Total	28	Severe	Yes		NR
Ammonium Phosphate, 5%	140	No	Total	1	Severe	No	Solution turned green	NR
	Room	No	Total	4	Severe	No	Solution turned green	NR
	Room	Yes	Total	4	Severe	No	Solution turned green	NR
	140	No	Total	17	Severe	Yes	Solution turned green	NR
Ammonium Sulfate, 5%	Room	Yes	Total	8	Severe	No		NR
	Room	Yes	Total	20	Severe	Yes		NR
Ammonium Sulfate, Sat'd.	Room	No	Total	8	Severe	No		NR
	Room	Yes	Total	20	Severe	Yes		NR
Amyl Acetate	Room	No	Total	24	0.0019	No		R
Amyl Alcohol	Room	No	Total	24	None measureable	No		R

(*Continued on next page*)

TABLE I (Continued)

CORROSION DATA ON CHEMICAL NICKEL PLATED PANELS

Commodity	Test Temp., °F	Aeration	Immersion	Test Time (Weeks)	Corrosion Rate (MPY)	Heat Treatment	Comments	Recommendation
Aniline Hydrochloride, Sat'd.	Room	No	Total	16	0.468	No		NR
Barium Chloride, Sat'd.	Room	No	Total	4	Severe	No		NR
Beer	45	No	Total	4	0.0078	Yes		R
	45	No	Total	4	0.217	No		NR
Benzol	Room	No	Total	24	0.0016	No		R
Benzyl Acetate	Room	No	Total	24	None	No		R
Benzyl Alcohol	Room	No	Total	20	0.0036	No		R
Benzyl Chloride	Room	No	Total	16	1.44	No	Panels tarnished	NR
Black Liquor Skimmings	Room	No	Total	12	0.01	No		R
Bleach Liquor	Room	No	Total	3	Severe	No		NR
Boric Acid Soln.	Room	No	Total	8	Severe	No		NR
Butyraldehyde	150	Yes	Total	3	0.2	No		—
	150	Yes	Total	3	0.6	Yes		—
Caprolactam Monomer	185	Nitrogen	Total	3	0.02	Yes (1150F)		R
	185	Nitrogen	Partial	3	0.02	Yes (1150F)		R
	185	Nitrogen	Total	3	0.02	No		R
	185	Nitrogen	Partial	3	0.03	No		R
Carbon Disulfide	Room	No	Partial	21	None	No		R
Carbon Tetrachloride	Room	No	Total	32	None	No		R
Cetyl Alcohol	160	No	Total	8	None	No		R
Chromic Acid, Sat'd.	Room	No	Total	4	Severe	No		NR
Cobalt Linoleate	Room	No	Total	16	None	No		R
Citric Acid, 5%	Room	Yes	Total	4	0.0744	No	Solution turned green	NR
Cresylic Acid	Room	No	Total	16	None	No		R
Cyanamide, Liquid	Room	Yes	Total	3	0.898	No	Solution turned green	NR
Dibutyl Phthalate	Room	No	Total	8	None	No		R
Diphenyl	Molten	No	Total	8	0.009	No		R
2,4 Dichlorophenol	160	Yes	Total	1	10.9	No		NR
	160	Yes	Total	1	6.8	Yes		NR
	240	Yes	Total	3	18.2	No		NR
	240	Yes	Total	3	12.8	Yes		NR
Ethyl Alcohol	Room	No	Total	24	0.0065	No		R
Ethylene Glycol	Room	Yes	Total	3	0.025	Yes		R
Fluorophosphoric Acid	Room	No	Total	2	Severe	No		NR
Gasoline	Room	No	Total	4	0.022	No		R
Hydrochloric Acid Solutions, *p*H 1.5–4.0	Various conditions tested				Severe			NR
Hydroxyacetic Acid	100	Yes	Total	3	1.9	No	Solution turned green	NR
Hydroxyacetic Acid	100	Yes	Total	3	2.6	Yes	Solution turned green	NR
Iso Amyl Octyl Orthophosphate	Room	No	Total	3	None	No		R
Lactic Acid, 45%	Room	No	Total	1	0.3	No		NR
"Lecton" Wire Enamel + 4.5% (vol.) NH_4OH *p*H = 9.6	105	Yes	Total	3	None	Yes		R
	105	Yes	Total	3	0.24	No		NR
"Lecton" Wire Enamel + 4 vols. water + 0.7% NH_4OH. *p*H = 9.4	105	Yes	Total	3	None	Yes		R
	105	Yes	Total	3	2.2	No		NR

(*Continued on next page*)

TABLE I (Continued)

CORROSION DATA ON CHEMICAL NICKEL PLATED PANELS

Commodity	Test Temp., °F	Aeration	Immersion	Test Time (Weeks)	Corrosion Rate (MPY)	Heat Treatment	Comments	Recommendation
"Lecton" Wire Enamel + 5% (vol.) NH_4OH pH = 10	105	Yes	Total	3	0.69	Yes		NR
	105	Yes	Total	3	1.5	No		NR
Lemon Juice (canned)	Room	No	Total	4	0.23	No		NR
Lemon Juice (raw) + 0.1% Na Benzoate	Room	No	Total	3	Severe	No		NR
Methyl Alcohol	Room	No	Total	24	None	No		R
Monochloracetic Acid Solution	Room	No	Total	1	Severe	No		NR
Naphtha, Odorless	Room	No	Total	3	None	No		R
Oleic Acid	Room	No	Total	10	0.012	No		R
Petroleum-White Oil	Room	No	Total	3	None	No		R
Petroleum-Sour Crude	Room	No	Total	2	None	No		—
Phosphoric Acid, 85%	140	No	Total	½	Severe	No		NR
Photographic Developer	Room	No	Total	4	None	No		R
Photographic Hypo	Room	No	Total	4	None	No		R
Resin (Amine)	120	Yes	Total	3	None	No		R
	120	Yes	Partial	3	None	No		R
Resin (Polyester)	120	Yes	Total	3	None	No		R
	120	Yes	Partial	3	None	No		R
Resin (Alkyd)	120	Yes	Total	3	None	No		R
	120	Yes	Partial	3	0.05	No		R
Rosin Size	210	Yes	Total	3	None	Yes		R
Sodium Carbonate, 10%	Room	No	Total	20	None	Yes		R
	Room	No	Total	20	None	No		R
Sodium Chloride, 3%	Room	No	Total	4	0.017	No		—
	Room	No	Total	32	0.04	Yes		—
	Room	Yes	Partial	4	Severe	No		—
	Room	Yes	Total	10	Severe	Yes		—
Sodium Cyanide, 5%	Room	No	Total	4	0.52	No		NR
Sodium Formate Slurry	150	Yes	Total	3	0.3	Yes	Solution turned black	NR
	150	Yes	Total	3	0.4	No	Solution turned black	NR
Sodium Hydroxide, 73% (lab tests)	250	Yes, plus shaking	Partial	4	0.07	No		R
	250	Yes, plus shaking	Total	4	0.07	No		R
	250	Yes, plus shaking	Partial	4	0.3	Yes		R
	250	Yes, plus shaking	Total	4	0.09	Yes		R
Sodium Hydroxide, 73% (lab tests)	200	No	Total	3	0.01	No		R
	200	No	Total	3	None	Yes		R
Sodium Hydroxide, 73% (lab tests)	250	No	Total	3	0.01	No		R
	250	No	Total	3	0.03	Yes		R
Sodium Hydroxide, 50% (lab tests)	200	No	Total	3	None	No		R
	200	No	Total	3	None	Yes		R
	250	No	Total	3	None	No		R
	250	No	Total	3	None	Yes		R

(Continued on next page)

TABLE I (Continued)

CORROSION DATA ON CHEMICAL NICKEL PLATED PANELS

Commodity	Test Temp., °F	Aeration	Immersion	Test Time (Weeks)	Corrosion Rate (MPY)	Heat Treatment	Comments	Recommendation
Sodium Hydroxide, 50–73%					0.2	Yes	Panels at splash level	R
Panels exposed in tank cars for 6–8 months. Time included empty periods					0.04–0.1	Yes	Panels near bottom of tank	R
Sodium Hydrosulfide, 40%	Room	Yes	Total	12	None	No	Panel badly tarnished and covered with film	—
Stearic Acid	158	No	Total	4	0.02	No		R
Sugar, Liquid	Room	No	Total	16	None	No		R
Sulfuric Acid, 1%—								
Concentrated	Numerous conditions tested				Severe			NR
Tall Oil, Crude	100	Yes	Total	3	0.03	No		R
	350	No	Total	3	0.2	No		—
	100	Yes	Partial	3	0.03	No		R
	100	Yes	Partial	3	0.04	Yes		R
Tall Oil, Refined	Room	No	Total	28	0.017	No		R
Urea, Sat'd. Soln.	Room	Yes	Total	28	None	Yes		R
	Room	Yes	Total	28	None	No		R
Urea, 25% Soln.	Room	Yes	Total	28	None	Yes		R
	Room	Yes	Total	28	None	No		R
Vinegar	Room	No	Total	3	Severe	Yes		NR
Water, Deionized	Room	Yes	Total	32	None	No		R
	120	Yes	Total	32	None	No		R
	180	Yes	Total	32	None	No		R
Wine, Sherry	40	No	Partial	4	0.377	No	Wine contaminated	NR
Zinc Ammonium Chloride	230	No	Total	3	Severe	Yes		NR

rosion specimens contained essentially nickel ions (as nickel sulfate) between 0.07–0.08 M; hypophosphite anions (as sodium hypophosphite) between 0.22 and 0.30 M—the ratio

$$\frac{\text{nickel ions}}{\text{hypophosphite ions}}$$

being kept between 0.3 and 0.4;[5] sodium lactate, a relatively inexpensive nickel chelating agent and buffer which also increases the rate of deposition at the proper concentration[13] (about 0.3 M); an "exaltant"[6, 14], namely propionic anion (0.03 M); and controlled trace amounts of a dehydrogenation anti-catalyst for stabilization purposes.[11, 16] The *p*H was kept substantially constant around 4.5 ± 0.2; and the operating temperature was about 95C (±3°). While this plating solution is not the most efficient for all base materials, nor the fastest, it represents a practical compromise between universality, quality of deposits and economy. The resultant coating averaged 8.3% P (with extremes from 7 to 10% P).

HEAT TREATMENT

According to all published data, independent investigations by the Armour Research Foundation, Government agencies and general industrial laboratories, "as deposited" chemical nickel plating is a unique material in that it is a noncrystalline solid with the structure of a super-cooled *liquid*.[18] After heat treatment, for instance at 400C for a short period, the material becomes crystalline in nature and consists of nickel phosphide finely dispersed in nickel. Thus, as might be expected, some differences can be detected in corrosion rates between "as deposited" and heat treated plating. A thorough discussion of the technology of heat treatment is given in the article by Goldenstein, Rostoker, Schossberger and Gutzeit.[19]

RESULTS

Table I describes the various corrosion tests conducted. Specific rates are given only in those cases where the attack was limited to the plating alone. These rates were determined by weight loss method. If attack of the base metal or other non-uniform reaction occurred, no specific rate was calculated. Every attempt was made to conduct these tests to give data on the influence of the commodity on Kanigen plating only.

In the corrosion field, chemical nickel plating has particular application in the prevention of iron contamination and commodity discoloration. For this reason it is useful particularly where the corrosion rates are less than 0.1 mil per year.

Below is given a list of these commodities where the rate is lower than this figure:

Acetone	Ethylene Glycol
Acetylene Bromide	Gasoline
Acrylonitrile	Isoamyl Octyl Orthophosphate
Allyl Chloride	Methyl Alcohol
Amyl Acetate	Naphtha
Amyl Alcohol	Oleic Acid
Beer	Petroleum White Oil
Benzol	Photographic Developer
Benzyl Acetate	Photographic Hypo
Benzyl Alcohol	Resin (amine)
Black Liquor Skimmings	Resin (polyester)
Caprolactam Monomer	Resin (alkyd)
Carbon Disulfide	Rosin Size
Carbon Tetrachloride	Sodium Carbonate, 10%
Cetyl Alcohol	Sodium Hydroxide
Cobalt Linoleate	Sugar, Liquid
Cresylic Acid	Tall Oil, crude
Dibutyl Phthalate	Tall Oil, refined
Diphenyl	Urea Solutions
Ethyl Alcohol	Water, deionized

OUTDOOR EXPOSURE TESTS

Panels of various base metals, coated with "electroless" nickel according to the process used have been subjected to outdoor exposure at General American's tank storage terminal in Corpus Christi, Texas. The racks are located on the ship channel where they are exposed to a mild salt, humid, industrial atmosphere. The test panels are 4 by 6 inches, and the racks are inclined at 45° and face south. (Conditions ASTM-B8). Variations in pretreatments, coating thickness, base material, surface roughness and post plating treatments have been studied. Five panels were exposed for each test variable.

All panels have been graded using photographic standards furnished by the International Nickel Company and in accordance with procedures outlined in reference 20. The type of failure generally experienced with electroless nickel coatings over ferrous alloys is different than that obtained with electroplated nickel. In the former case, pin point rusting usually occurs, and corrosion does not spread out from a failure point. With electroplated nickel there is more of a tendency for individual failure areas to increase in size. With aluminum alloys, blister types of failure are most common with both types of coatings.

The test program reported here showed that surface roughness of the substratum contributes to failure of the coating. Under identical conditions the smoother the base material, the longer the life of the coating. (Where grease polishing is used to obtain greater smoothness, extra care in pretreatment of the base material is necessary to assure a clean surface.)

In order to obtain optimum corrosion resistance to outdoor exposure on steel, it has been found that the best results were obtained with the use of post plating heat treatment for 4 hours at 1400F and pretreatment of the base metal using a high temperature molten salt bath cycle. To limit rusting to 0.25–0.5 per cent of the surface over periods greater than 12 months requires a coating thickness of better than two mils. This summary applies to SAE 1010, 1018, 1095 and 4130 steels.

Surprisingly good results have been obtained using electroless nickel directly over various aluminum alloys where coating thicknesses of at least two mils were used. Three alloys, 24S, 52S and 61S, have been studied. Three years exposure without significant failure have been obtained. The best pretreatment cycle incorporated vapor degreasing, cleaning with dilute sodium hydroxide-sodium nitrite, a ferric chloride-hydrochloric acid pickle and a bright dip in a hydrofluoric acid-nitric acid solution.

CONCLUSIONS

Electroless nickel plating is a unique coating method which can make a definite contribution to decreasing corrosion losses of structural materials from either chemical or weathering attack. This paper has summarized our present knowledge regarding its applications for this purpose.

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A LITERATURE REVIEW ON THE USE OF MOLYBDENUM AS AN ALLOY IN ELECTRODEPOSITS

By JANET Z. BRIGGS and H. W. SCHULTZE*

THERE HAS BEEN INCREASING interest among electroplaters in the possibilities offered by deposits containing more than one metal. The aim of the present literature review is to point out how various types of electrodeposits can be improved by the addition of molybdenum. Among the significant results that have been reported are the effect of about 1 per cent Mo in increasing the wear resistance of hard chromium plate by three to eight times, and the tarnish-free behavior of bright iron-molybdenum plates. In other alloys, the molybdenum appears to be particularly beneficial in contributing not only corrosion and wear resistance, but also hot hardness and better magnetic and electrical properties.[1, 2, 3, 4]

Iron, cobalt and nickel appear to be the only elements that make possible the codeposition of substantial amounts of molybdenum, which in some cases can amount to 50 to 60 per cent. Molybdenum does not codeposit with tungsten alone[5] although both metals can be deposited together in ternary alloys. Alloys of molybdenum with some other metals can be deposited from certain solutions but very high current densities are required and the current efficiency may be very low. The amount of molybdenum in the deposit is often so small as to raise the question as to whether it is really present as an alloy or merely adsorbed on the surface or occluded as a salt.[4]

Electrodeposition of molybdenum metal itself has proved comparatively difficult. Conventional deposition methods generally produce mixtures of molybdenum oxides or extremely thin, nonprotective films of molybdenum. The only method that has successfully given massive deposits is the Bureau of Standards' fused-salt process, which has not been exploited commercially. Coatings of molybdenum metal are much more expeditiously applied by methods other than electroplating, such as spraying or vapor deposition.[6]

CHROMIUM-MOLYBDENUM ALLOYS

Dense, adherent deposits with high corrosion and wear resistance can be obtained by codeposition of chromium and molybdenum. The wear resistance appears to be most remarkable. Jacquet and his co-workers[7] determined the wear resistance of chromium electrodeposits containing 0.8–1 per cent Mo in an Amsler machine, where the friction against a steel sleeve gave a combination rolling and sliding motion. Electrolytically polished, the chromium-molybdenum deposits had a wear resistance three to four times that of ground hard-chromium plate; the superiority of the ground chromium-molybdenum deposits was six to eight times that of the hard chromium.

Most of the work has been done in standard chromium plating baths, to which the molybdenum has been added as molybdic oxide or molybdic acid.[8, 9] Ma[10] has also suggested use of molybdenum or chromium-molybdenum anodes to avoid depletion of molybdenum during plating. Increasing concentrations of molybdenum in the bath have led to increased molybdenum contents in the deposits but the upper limit is set by the precipitation of molybdenum chromate from the bath.

The majority of deposits reported have contained under 2 per cent Mo. In his extensive work, Shome[11] arrived at an optimum deposit with 1.7 per cent Mo, using a bath containing 400 g/l chromic acid, 360 g/l molybdic acid and 4 g/l sulfuric acid, operated at a temperature of 40C and a current density of about 15 amp/sq dm. This coating was dull but could be polished. With lower sulfate/chromate ratios, bright deposits could be obtained but the throwing power was poor.

All investigations have reported that the current efficiency decreased as the molybdenum content of the deposit increased. With higher current densities, Shome got deposits with higher percentages of molybdenum (up to 5.8 per cent) and some oxygen. Ma, using similar temperatures and current densities but a lower chromic acid content, reported a deposit with 22.4 per cent Mo; Holt,[12] however, was unable to get deposits with over 1 per cent Mo from this bath.

COBALT-MOLYBDENUM ALLOYS

Cobalt-molybdenum alloys can be deposited from a large variety of baths, as indicated by typical examples in the following table. Electrodeposition offers no problems, and molybdenum contents up to about 50 per cent—depending on the bath and deposition conditions— can be obtained.[9, 13]

The properties of the deposits are most interesting. Bright deposits can be obtained in several of the baths, and a number of investigators have stressed the good corrosion resistance of cobalt-molybdenum plates. Myers,[14] for instance, found that his cobalt-molybdenum deposits showed less corrosion than nickel plates in intermittent brine immersion tests. By analogy with wrought alloys, it would be assumed that most of these deposits would have high hot hardness and consequently high resistance to erosion at elevated temperatures.

COPPER-MOLYBDENUM ALLOYS

Copper-molybdenum deposits do not appear promising as they lack any positive virtues.

Myers[14] obtained deposits with up to 15 per cent Mo from a bath containing 6.4 g/l copper sulfate, 20 g/l molybdic oxide, 80 g/l sodium bicarbonate and 60 g/l sodium pyrophosphate, used at room temperature with a current density of about 4 amp/sq dm. The nonmagnetic deposits had an attractive pink color but tarnished rapidly and generally were more active chemically than copper. Smooth bright deposits resulted under some conditions but the plates were quite brittle, probably because of the oxide content.

Skewes[24] also found brittle deposits were obtained in electrorefining of copper with as little as 0.03 per cent Mo in the deposit. The oxidation state of the molybdenum in the bath was important as molybdenum with lower valences did not codeposit.

France[25] has indicated that molybdic acid is an essential constituent of a complex brightener for copper plating solutions, but no figures on actual molybdenum content of the deposit are given nor is any specific action attributed to the molybdenum alone.

*Climax Molybdenum Co., a Division of American Metal Climax Inc., New York

TABLE I
ELECTRODEPOSITION OF BINARY COBALT-MOLYBDENUM ALLOYS

Bath			Cathode			Deposit			
Type	Typical Composition	Temperature, C	Current Density amp/sq dm	Efficiency Per Cent	Anode	Molybdenum Content Per Cent	Properties	Notes	Ref
Acetate	Molybdic anhydride.. 66 g/l Ammonium acetate..... 660 g/l Potassium acetate..... 660 g/l Glacial acetic acid..... 130 cc Cobalt sulfate (0.1 M).... 13 cc *p*H (approximate)..... 6	40	25	—	Pt, C	—	Bright, metallic	—	15, 16
Carbonate	Potassium carbonate..1000 g/l Cobalt..... 15 g/l Sodium molybdate..... 100 g/l *p*H..... 11	110	3	up to 100	Co, Mo, W	—	Very hard, highly resistant to corrosion, very durable under extremely high-temperature conditions	Plating temperature can be as high as 135C; higher temperatures give sounder deposits. When plated at lower temperatures, deposits tend to contain oxides. As plating temperature increases, molybdenum content decreases. Higher current densities produce a rather rough deposit. Bath is stable but must be caustic free. Any soluble cobalt salt can be used, such as acetate, chloride or sulfate. Any other soluble salt of molybdenum is suitable except ammonium molybdate. Tungsten does not codeposit if tungsten anode used.	17
Citrate	Cobaltous sulfate..... 155 g/l Sodium citrate..... 294 g/l Sodium molybdate.. 206 g/l Ammonium hydroxide to adjust *p*H *p*H.....10.5	25	10	55	Insoluble (soluble would probably be preferable in commercial operation)	up to 40	Gray to bright color, metallic. At low current densities around 1 amp/sq dm, deposit is black and nonmetallics in center. Under some conditions bright deposits were obtained, but these were cracked. Adhesion to flat cathodes was good, but adhesion to rods and tubing was not as good.	As current density increases, molybdenum content of deposit decreases and cathode efficiency increases. Molybdenum content also decreases as bath temperature increases. Citric acid was used in earlier work[20, 21], but sodium citrate was found[18] to be a superior complexing agent.	18, 19

(*Continued on next page*)

GOLD-MOLYBDENUM ALLOYS

The electrodeposition of small amounts of molybdenum with gold has been reported to cause a notable increase in abrasion resistance and to give a more economical gold plate by making possible a decrease in the thickness of deposit necessary for a given period of service.

A typical bath contained 4 g/l fine gold, 4 g/l potassium molybdate, 15 g/l free potassium cyanide and 7.5 g/l potassium hydroxide. Anodes were stainless steel; a 0.0003-in.-thick deposit containing 0.005 to 0.05 per cent Mo (determined spectrographically) was obtained in 30 minutes at 65 to 75C with a current density of about 140 amp/sq dm. The molybdenum-containing gold deposit had a light gold color ("Hamilton" gold), considered most desirable in the trade. In tests involving abrasion by steel balls in a tumbling barrel, the molybdenum-containing gold plate had approximately six times the abrasion resistance of standard gold plates. Consequently, the former would be expected to be more resistant to scratching and to retain its luster longer.[25]

IRON-MOLYBDENUM ALLOYS

Iron-molybdenum alloys can be electrodeposited under conditions similar to those applying to cobalt-molybdenum alloys.[14, 15, 16, 18, 19, 20, 21, 22, 26, 27] For instance, the citrate, fluoride and free-alkali baths shown for cobalt can be used for iron-molybdenum alloys by simply substituting the equivalent iron compound for the cobalt salt. In general, however, the molybdenum content is higher in iron-molybdenum deposits than in cobalt-molybdenum and the cathode current efficiency is appreciably lower. Also, the tendency for nonmetallic deposits to form appears to be somewhat greater with iron-molybdenum than with cobalt-molybdenum deposits. Two baths that differ in certain respects from those used for cobalt-molybdenum are covered in Table II.

Of all the work done on iron-molybdenum alloys, the most interesting is that of Case and Krohn[28] who undertook a comprehensive study of this system with the aim of increasing the efficiency and developing a commercial plating bath. This investigation shows the significant improvements feasible in many of the experimental baths if they are examined with commercial conditions in mind. After an extensive development, involving some 300 plating runs in the preliminary work alone, Case and Krohn arrived at a most satisfactory bath by modifying Myers'[14] pyrophosphate formula. Notable was the marked improvement in cathode efficiency obtained by including means for wiping the cathode. A complete study of the variables showed it was possible to electrodeposit bright plates containing about 60 per cent Mo, 6 per cent O and 33 per cent Fe, with good properties in thicknesses up to about 0.0004 in. Additional investigations will be needed to determine fully the utility of these coatings, not only as regards corrosion resistance but also hot hardness, wear resistance, frictional characteristics and response to heat treatment. It is significant, however, that iron-molybdenum electrodeposits have remained bright and untarnished for over five years.

NICKEL-MOLYBDENUM ALLOYS

In view of the widespread commercial applications for wrought and cast nickel-molybdenum alloys, especially in corrosion- and heat-resistant fields, it might be expected that nickel-molybdenum deposits would be applicable for similar uses. So far sufficient data on the properties of these deposits are not available to indicate if this will be so.

Codeposition of molybdenum and nickel bears many resemblances to codeposition of molybdenum with cobalt and

TABLE I (Continued)
ELECTRODEPOSITION OF BINARY COBALT-MOLYBDENUM ALLOYS

Bath			Cathode			Deposit			
Type	Typical Composition	Temperature, C	Current Density amp/sq dm	Efficiency Per Cent	Anode	Molybdenum Content Per Cent	Properties	Notes	Ref
Fluoride	Molybdic oxide..... 34 g/l Potassium fluoride dihydrate... 675 g/l Hydrofluoric acid (48%)..... 88 cc Cobalt sulfate solution (0.02 g Co/cc)..... 40 cc	40	20	—	Carbon	—	Metallic, smooth bright	—	22
Free Alkali	Sodium molybdate..... 20 g/l Cobalt sulfate..... 10 g/l Sodium hydroxide.. 250 g/l Sodium carbonate 80 g/l Dextrose..... 20 g/l	20	0.4	—	Insoluble	—	Bright, very hard, adherent, resistant to tarnishing by atmosphere and by action of 3% brine solution	—	23
yro-P phosphate	Cobalt sulfate..... 9.6 g/l Molybdic oxide..... 20 g/l Sodium bicarbonate..... 80 g/l Sodium pyrophosphate.. 60 g/l	25	3	15	Pt	50	Bright, smooth, moderately magnetic deposits with little evidence of brittleness. Not acid resistant but very good resistance in intermittent brine immersion test—better than nickel plate	Oxygen content of deposit, normally about 10%, decreases sharply with increasing temperature. Increasing cobalt in bath causes increases in cobalt content of deposit and pronounced improvement in current efficiency. Efficiency also affected markedly by current density and temperature. Bath has good stability.	14

TABLE II
ELECTRODEPOSITION OF BINARY IRON-MOLYBDENUM ALLOYS

Bath			Cathode			Deposit			
Type	Typical Composition	Temperature, C	Current Density amp/sq dm	Efficiency Per Cent	Anode	Molybdenum Content Per Cent	Properties	Notes	Ref
Formate	Molybdic anhydride.. 30 g/ Potassium hydroxide.. 360 g/l Ammonium hydroxide.. 330 cc (28% NH_3) Formic acid (87%)..... 450 cc Ferrous sulfate (0.1 M).... 180 cc	35	20	—	—	—	Bright, metallic	—	16
Pyrophosphate	Sodium molybdate.. 40 g/l ($Na_2(MoO_4) \cdot 2H_2O$) Ferric chloride 9 g/l ($FeCl_3 \cdot 6H_2O$) Sodium pyrophosphate.. 45 g/l ($Na_4P_2O_7 \cdot 10H_2O$) Sodium bicarbonate..... 75 g/l pH..... 8.0	50	16	40	Pt	60	Bright, smooth, adheres well, hard, brittle, numerous cracks but good resistance to tarnishing in atmosphere as well as to corrosion in alkaline solutions and in sulfuric + phosphoric, hydrochloric and perchloric acids	Efficiency has been greatly increased over previous pyrophosphate baths by wiping cathode, which is rotated between rubber wiper blades.	23

iron. Nickel-molybdenum alloys can be deposited from baths analogous to a number of those used for cobalt-molybdenum: acetate, citrate, fluoride and pyrophosphate. The cathode efficiency, however, is generally higher for the nickel-molybdenum alloys than for the cobalt-molybdenum and iron-molybdenum alloys, while the molybdenum content of the deposit is usually lower.[14, 15, 16, 18, 19, 20, 21, 22, 37, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42] For instance, nickel-molybdenum deposits from citrate baths contain about 20 per cent Mo. In pyrophosphate baths, the nickel is added in the form of the chloride (as with iron) rather than the sulfate as indicated for cobalt.

The following table indicates two types of solutions that are suitable only for nickel-molybdenum alloys but not for other metals of the iron group. The ammoniacal baths are said to have a number of advantages over citrate baths, particularly in respect to cost and ease of operation. The borate baths, which are characterized by high rates of deposition and high throwing power, have been used commercially to deposit jet-black deposits having both ornamental and protective properties on base materials such as zinc and cadmium. It will be noted that these deposits are actually nonmetallic with about 45 per cent O, 45 per cent Mo and 10 per cent Ni. See Table III.

Mention might also be made of the role of molybdenum in electroless nickel deposition. A recent General Motors patent[43] covers a modification of the hypophosphite method where molybdenum up to 0.02 g/l (in the form of soluble molybdenum compounds such as molybdic acid) is used to inhibit decomposition while allowing the plating reaction to continue. Therefore, more flexibility in the choice of a bath temperature and other variables is possible so as to obtain increased rates of deposition and superior deposits. The Bureau of Standards[44] has reported an interesting alternative to the conventional hypophosphite method although it is not as simple and practicable; the alternative is based on reduction of nickel (or cobalt) in alkaline solution by lower-valent molybdenum compounds.

ZINC-MOLYBDENUM ALLOYS

One of the more popular methods of depositing bright zinc coatings depends on codeposition of small amounts of molybdenum. Soluble molybdenum compounds in amounts from 0.05 to 1 per cent are added to a cyanide zinc bath to produce a brilliant finish without subsequent polishing. The deposits contain somewhat under 1 per cent Mo, probably in the form of one of the lower oxides of molybdenum.[45, 46, 47, 48, 49]

Experimentally, Myers[14] produced zinc-molybdenum deposits from pyrophosphate baths. The basic solution gave dull gray deposits, but some preliminary work indicated that suitable addition agents would whiten and brighten the deposits. Intermittent brine immersion tests showed unusually good corrosion resistance for such deposits with about 4 per cent Mo and 6 per cent O; the protective action lasted about ten times as long as with pure zinc deposits.

Since many wrought and cast materials are ternary or quaternary alloys, the ability to electrodeposit such compositions would extend the usefulness of the electrolytic process. It has actually been found that ternary and quaternary alloys can usually be electrodeposited by suitable combinations of baths for binary alloys. For instance, Myers[14] states that, if salts of two or more of the five carrier metals determined to be effective in his work (iron, cobalt, copper,

TABLE III
ELECTRODEPOSITION OF BINARY NICKEL-MOLYBDENUM ALLOYS

Bath			Cathode			Deposit			
Type	Typical Composition	Temperature, C	Current Density amp/sq dm	Efficiency Per Cent	Anode	Molybdenum Content Per Cent	Properties	Notes	Ref
Ammoniacal	Ammonium hydroxide (25%).. 200 cc/l Nickel sulfate.... 12 g Ni/l Ammonium molybdate.... 6 g Mo/l Sodium chloride.... 3 g/l *p*H.....10.7	35	10	up to 50	— See [62] for use of soluble anodes in a similar solution. Ni more satisfactory than Ni-Mo.	18	Smooth, bright	Increasing current density gives decreasing molybdenum in deposit. Current efficiency increases with decreasing molybdenum in electrolyte. Ref [62] gives a slightly different bath of this type, which also contains 70 g/l sodium tartrate. The higher the anodic current density, the greater must be the concentration of chlorine ions in solution for good performance.[62]	[22]
Borate	Boric acid.... 48 g/l Nickel sulfate. 30 g/l ($NiSO_4 \cdot 6H_2O$) Sodium molybdate. 22.5 g/l Molybdic oxide..... 15 g/l Sodium thiocyanate.... 3.8 g/l *p*H..... 4.0	70	0.5	—	Graphite	45	Nonmetallic, with about 45% O. Ornamental and protective; may also be used as electrical insulator. Most suitable for zinc, cadmium, tin, lead and some aluminum bases. Usually jet black, but can vary depending on exact bath composition. Abrasion resistance and adherence improved by heating deposit, for example in boiling water for 5 to 15 min.	High throwing power deposits about six times as fast as nickel. Any soluble molybdenum compound except ammonium molybdate can be used; both acid and alkaline baths feasible. Copper must be avoided as it turns deposit brown. 0.75 g/l glycerol improves adherence.	[34, 14, 39]

nickel and zinc) are used in his pyrophosphate baths, the plate deposited will contain molybdenum, oxygen and the added carrier metals. The proportions of the metals deposited can be varied by changing the bath composition, current density and temperature, similarly to the deposition of alloys with molybdenum and only one other metal. Myers gives no details on the properties of these multicomponent deposits.

McElwee and Holt[10] in their basic study of cobalt-molybdenum-tungsten deposition (discussed below) also mention that a number of other ternary alloys can be electrodeposited from the citrate type of plating solution: cobalt-nickel-molybdenum; iron-cobalt-molybdenum; iron-nickel-molybdenum; iron-tungsten-molybdenum and nickel-tungsten-molybdenum. Unfortunately, no specific tests on these deposits are reported.

COBALT-CHROMIUM-MOLYBDENUM ALLOYS

Fassell and Baur[9] determined that addition of either chromium to their successful cobalt-molybdenum baths, or molybdenum to successful cobalt-chromium baths, resulted in failure of one or the other to codeposit. Some encouraging results were obtained, however, when the metal ions were added by anodic dissolution of high-temperature alloys and subsequent deposition.

COBALT-MOLYBDENUM-TUNGSTEN ALLOYS

Cobalt-molybdenum-tungsten alloys have been satisfactorily deposited from citrate baths,[10] which were used simply because much of the previous work on tungsten and molybdenum alloys had been done with this type of bath. The investigation was largely devoted to electroplating variables. The best appearing deposits were obtained from baths having tungsten:molybdenum mole ratios of 8:2 to 5:5. At the high tungsten end, the deposits tended to flake off the cathode; at the high molybdenum end, the deposits became streaked and discolored. Plates containing 66 per cent Co, 21 per cent Mo and 13 per cent W could be deposited with a cathode current efficiency of 73 per cent.

Evidently, these ternary alloys cannot be produced in all types of baths. For instance, as indicated in the table on cobalt-molybdenum deposits, tungsten does not codeposit with cobalt and molybdenum from a carbonate bath.

COPPER-ZINC-MOLYBDENUM ALLOYS

A small amount of a water-soluble molybdenum compound has been added to baths containing cyanides of zinc and copper for electrodeposition of "white brass."[51] Deposits of

this type have been used as partial replacements for nickel plating.[52]

NICKEL-IRON-MOLYBDENUM ALLOYS

This type of alloy has found wide usage in wrought form as a result of its high permeability. Similar potential applications would doubtless exist for electrodeposited coatings if it were possible to develop a procedure for producing stress-free deposits with adequate physical properties. It has also been suggested that such ternary alloys would make an excellent raw material for producing soft-magnetic parts by powder metallurgy and would be more satisfactory than simple mixtures of unalloyed metal powders.

Most of the work along this line has been limited to molybdenum contents comparable to those found in wrought alloys of the "Permalloy" type, that is, around 3 per cent. One series of tests[53] indicated that suitable alloys with 20 per cent Fe and 3 per cent Mo could be deposited but that deposits with higher molybdenum contents were cracked and brittle. Deposits with up to 5 per cent Mo have been produced from citrate baths.[27, 54]

One of the difficult factors in deposition of ternary alloys is uniformity of composition, particularly under commercial plating conditions. Control of the variables involved has been discussed at considerable length by Soviet investigators,[54] who used a citrate-type bath. They found that deposition of uniform ternary alloys required much more care than binary alloys. Among the items that proved important were: maintenance of a careful watch on bath composition and particularly keeping the iron in the ferric state; provision of uniform current distribution on the cathode; use of soluble anodes of approximately the same composition as the desired deposit; addition of a neutral salt to the bath (sodium chloride was best); and adequate circulation of the bath. No magnetic properties are given for the deposits, but X-ray examination showed they were less stressed than equivalent binary nickel-molybdenum deposits.

NICKEL-IRON-MOLYBDENUM-COPPER ALLOYS

Since wrought nickel-iron-molybdenum magnetic alloys are improved by the addition of small amounts of copper, an attempt was made to electrodeposit quaternary alloys of this type. A single-phase deposit could be produced from a citrate-type bath.[55] Pilot-plant tests over a longer period of time indicated suitable reproducibility and uniformity of composition.

NICKEL-IRON-MOLYBDENUM-MANGANESE ALLOYS

Small additions of manganese are also reported to have favorable effects on the magnetic properties of wrought nickel-iron-molybdenum alloys. It proved impossible, however, to electrodeposit alloys of this type from citrate baths with adequate uniformity of composition.[55]

THEORETICAL ASPECTS

The theoretical aspects of codeposition of molybdenum with other metals are intriguing but baffling. Among the facts that have to be covered by any adequate hypothesis are why molybdenum codeposits most readily with metals of the iron group, why substantial amounts of nonmetallic material (generally oxygen) are present in most deposits and why hydrogen plays such an important role in this codeposition. The major theories that have been proposed are the alternate layer theory, the oxide film theory, the hydroxide film theory, the induced codeposition theory and the bridge complex theory. None of the mechanisms postulated to date has proved capable of explaining completely all phenomena connected with the codeposition of molybdenum. Two good discussions of this subject have been given recently by Ernst and Holt[19] and Case and Krohn.[28]

CONCLUSIONS

The valuable preliminary research on the codeposition of molybdenum, which has dealt largely with theoretical aspects, should now be supplemented by developmental studies to adapt the experimental baths to commercial use. An indication as to what can be done along this line is given by Case and Krohn, who demonstrated the marked improvement in cathode efficiency resulting from wiping the cathode during deposition of iron-molybdenum plates. Additional work is also needed to determine more completely the properties of molybdenum-containing deposits and the effect of heat treatment on these deposits. Then it will be possible to determine practical applications where such deposits offer commercially significant advantages over presently used material.

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AN OUTLINE OF THE CHEMISTRY INVOLVED IN THE PROCESS OF CATALYTIC NICKEL DEPOSITION FROM AQUEOUS SOLUTION

(PART III)

by G. GUTZEIT*

A few experiments of a similar series, wherein the Ni^{++} concentration was kept constant and the $[H_2PO_2]^-$ concentration was varied, are shown in Table XIV.
Identical tests were performed at $Ni^{++}/[H_2PO_2]^-$ ratios of 0.105, 0.388 and 0.722. The average hypophosphite utilization (efficiency) in this experimental series calculates to 0.310 ± 0.07.

In order to determine if the hypophosphite utilization is substantially independent of bath composition, studies similar to those described above were performed with other plating solutions at 90 and 99C (containing also the required amount of stabilizer), for instance:

Bath A†		Bath B†	
Ni^{++}	0.0675 M/l	Ni^{++}	0.0675 M/l
$[H_2PO_2]^-$	0.225 M/l	$[H_2PO_2]^-$	0.225 M/l
Glycine (Amino-acetic acid)	0.0675 M/l	Malic acid	0.06 M/l
Malic acid	0.135 M/l	Lactic acid	0.2025 M/l
*p*H	6.32	Succinic acid	0.20 M/l
		*p*H	4.63

*Associate Director, Research and Development Department, General American Transportation Corporation, Chicago, Illinois.
†Patented in the United States and abroad.

At 90C, bath A gave an efficiency of 0.30 and, at 99C, an efficiency of 0.33. Bath B also showed 0.30 hypophosphite utilization at 90C and 0.31 at 99C.

It appears, therefore, that the reaction efficiency is practically independent, within the limits specified and selected in the range of suitable plating conditions, of the following variables:

A) *p*H (4.5 to 6.5)
B) Initial nickel concentration (0.05 to 0.28)
C) Initial hypophosphite concentration (0.12 to 0.84)
D) Organic additives (buffer, chelating agent, "exaltant")
E) Temperature (90–99C)

Finally, it has been stated by Brenner and Riddell[2] (R.P. 1835, loc. cit.) that the hypophosphite utilization is a function of the bath volume/plated area (V/A) ratio. This point was investigated, using a highly buffered acetate bath (described in connection with Reaction Mechanism studies). The relationship between deposition rate and area being plated was studied at constant bath volume. Table XV gives some of the data obtained (plotted in Fig. 11). The results demonstrate that the rate of deposition is a linear function of the area being plated; in other words, it is virtually constant per unit area. Furthermore, the observed stoichiometry of the

TABLE XIV

HYPOPHOSPHITE UTILIZATION DATA AT CONSTANT NICKEL CONCENTRATION

Bath:
Nickel: variable
Hypophosphite: 0.215 M ± 0.009 M
Sodium succinate: 0.06 M
Stabilizer (Pb^{++})
Temp. 99C ± 0.05C
*p*H 4.6

$Ni^{++}/[H_2PO_2]^-$	0.209		0.312		0.547	
Time (min)	Ni^{++} M	$[H_2PO_2]^-$ M	Ni^{++} M	$[H_2PO_2]^-$ M	Ni^{++} M	$[H_2PO_2]^-$ M
0	0.0934	0.0447	0.0885	0.284	0.0886	0.162
5	0.0797	0.0398	0.0724	0.248	0.0731	0.131
10	0.0679	0.0369	0.0659	0.224	0.0625	0.101
15	0.0617	0.353	0.0590	0.200	0.0560	0.083
20	0.0594	0.342	0.0569	0.194	0.0545	0.076
30	0.0532	0.321	0.0494	0.174	0.0496	0.064
45	0.0477	0.290	0.0466	0.157	0.0453	0.049

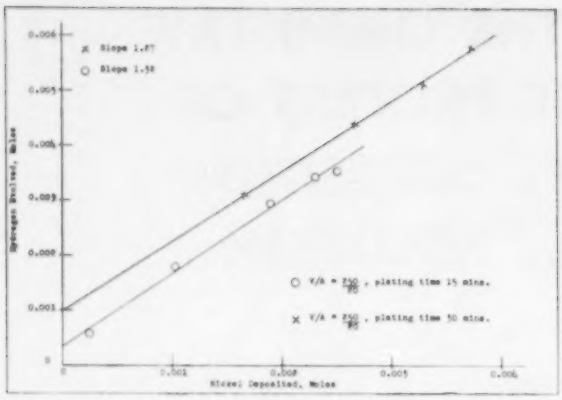

Hydrogen Evolved, Moles
Nickel Deposited, Moles
X Slope 1.87
O Slope 1.58
O Y/A = 250/80 , plating time 15 mins.
X Y/A = 250/80 , plating time 30 mins.

Fig. 10. Hydrogen evolved vs. nickel deposited in LP baths.

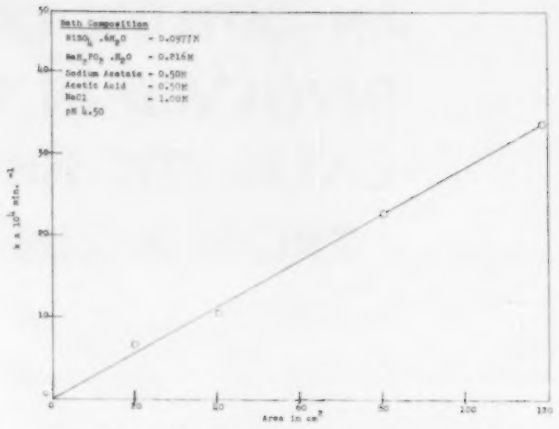


Fig. 11. Relationship between rate constant k_1 and plating area at constant volume, temperature—96C (See Table XV)

reaction was also constant independently of the area plated. This evidence refutes Brenner's findings.

TABLE XV

RATE OF DEPOSITION AS A FUNCTION OF PLATED AREA

Bath Composition

Ni^{++} (as $NiSO_4 \cdot 6H_2O$) ..... 0.10 M/l
Na $[H_2PO_2] \cdot H_2O$ ..... 0.23 M/l
NaOH ..... 0.50 M/l
Acetic Acid ..... 1.00 M/l
NaCl ..... 1.00 M/l
Pb^{++} ..... 2 ppm
Temperature 96.0–96.2C

Plated Area (cm^2) Armco Mild Steel	Rate Constant* $K \times 10^4$ min^{-1}	Total Plating Time (min)	Per cent Nickel in Coating
20	6.67	593	94.8
40	10.50	380	94.6
80	23.00	300	95.0
120	34.30	180	94.7

*$K = \frac{2.303}{t} \log^{10} \frac{a}{a-3x}$

a = initial hypophosphite concentration.
x = amount of nickel deposited.

CHEMISTRY OF BATHS FOR CONTINUOUS PLATING

BATH COMPOSITION AND OPERATING CONDITIONS

General Remarks

In order to achieve continuous and selective deposition of a nickel-phosphorus coating on an immersed solid body from an acid solution (without random reduction within the aqueous solution)—which is the most important technical requirement for successful industrial plating—at a rate consistent with production requirements, certain basic conditions have to be fulfilled:

1. The bath temperature must be above 85C.
2. The absolute concentrations of the nickel ions and of the hypophosphite ions must be kept within relatively low ranges, and within proper ratios.
3. The *p*H of the solution should not be allowed to decrease below a value of about 4.0 (where deposition becomes very slow).
4. Ortho-phosphite anions being produced continuously through oxidation of hypophosphite anions, it is necessary to avoid or delay as much as possible the precipitation of nickel ortho-phosphite (which would occur within a short time of bath operation, due to its relatively low solubility and would, in turn, induce bath decomposition).

From a practical point of view, there are a number of additional important conditions:

5. The rate of deposition should be consistent and produce a thickness of about 1 mil/hour or better.
6. The plating should be bright, smooth, uniform, virtually devoid of pores and other faults.
7. The operation should be as reliable, efficient and, of course, as economical as possible.

An aqueous solution containing nickel cations and hypophosphite anions is inherently meta-stable at elevated temperature. The stability decreases as the following values increase:

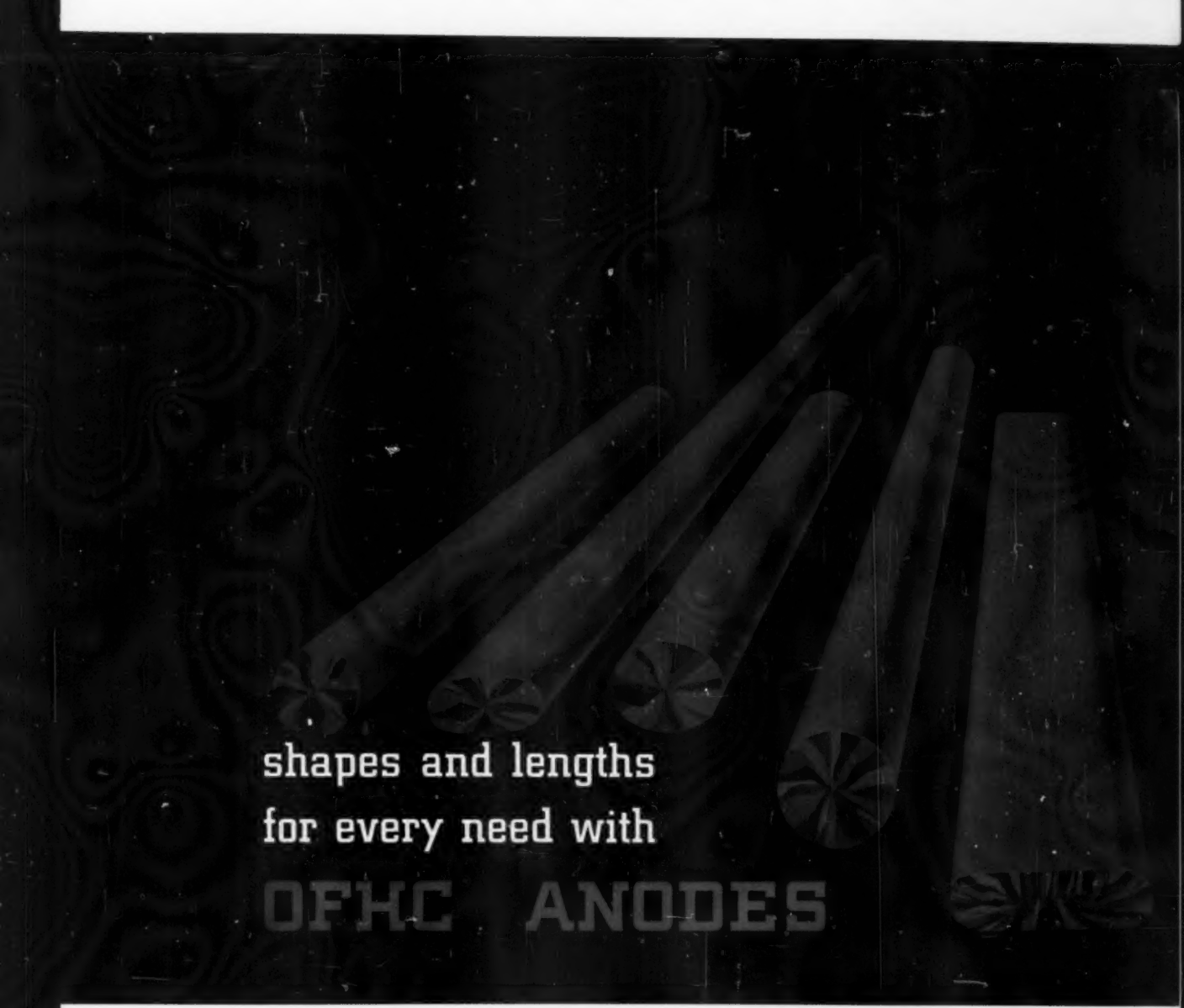
(a) temperature
(b) hypophosphite anion concentration
(c) OH^- concentration (*p*H)
(d) suspended solids concentration (dust, chemical precipitates, etc.)

On the other hand, this meta-stable condition is a prime requisite for nickel deposition, the rate being decidedly favored by an increase in (a) (b) and (c). Consequently, an "electroless" plating solution suitable for production represents a practical compromise between optimum possible plating rate and minimum risk of decomposition, at the lowest possible cost.

As a matter of fact, chemical nickel coating could only become a practical large-scale industrial process after the dual related and contradictory problems of high deposition rate and bath stability had been solved by General American Transportation Corporation's development work.

(*To be continued*)

INDICATE A 1226. ➤



If you have been searching for a *really long* anode that's ideal for close spacing, ask your OFHC Anode distributor about the 1½ x 3-inch oval, available up to 8 feet long! Or if you're using anode baskets, ask him about replacing forged balls with short slugs of OFHC 2-inch rounds. Whatever your anode shape requirements might be, you'll find an OFHC Anode that fits precisely, and in any length to 96 inches:

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• 1½″ x 3″ oval • 1½″x 5″ flat

And no matter which OFHC Anode shape you specify, you will be ordering the purest copper commercially produced. OFHC Anodes are 99.99+% copper, completely free of oxides, uncontaminated by residual deoxidants. For free assistance in putting OFHC quality to work—in the shape and length you need—contact your OFHC Anode distributor, or AMCO Technical Service Section directly.

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American Metal Climax, Inc.
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OFHC Anodes—Made Only by American Metal Climax—are Sold by Leading Plating-Supply Distributors Everywhere.

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Diversey's new electrocleaning development can boost your output ...and reduce costs

This could be the electrocleaning improvement you've been waiting for. The combination of Diversey No. 15 SOAK CLEANER plus new Diversey No. 35 ELECTROCLEANER means increased production . . . and lower cost per part. You get absolute cleanliness with smut-free, waterbreak-free surfaces. The treatment results in more adherent plate . . . sharply reduced rejects . . . lower costs.

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Get the facts now on the new cleaning combination that can give you better plating at less cost. See your Diversey D-Man or write Metal Industries Department, The Diversey Corporation, 1820 Roscoe Street, Chicago 13, Illinois.

DIVERSEY.

Semi-Annual Meeting

American Society for Testing Material

COMMITTEE B-8

Sheraton Hotel, Philadelphia, Pa.

October 15-16, 1959

Summary by

DR. EDWARD B. SAUBESTRE

Technical Director

Enthone, Inc., New Haven, Conn.

Committee B-8

C. Sample, Chairman

The membership of B-8 has risen to 207, largely due to the transfer of Subcommittee VI of B-7 (Anodic Coatings on Aluminum) to B-8. It was decided that the next meeting would be held in Chicago, the week of February 1. A suggestion that B-8 meet in Los Angeles immediately after the AES Convention was discussed at length, and will be submitted to letter ballot. The Sub-committee reports follow:

Sub-Committee I—Specifications

F. Ogburn, Chairman

B-200-55T, Lead on Steel was slightly modified by H. Kafarski and recommended for advancement as a Standard. This will be submitted for letter balloting. A task group is being set up to look into the use of lead for reasons other than as protection against atmospheric corrosion. W. Safranek reported completion of his group's work on definitions. W. Moline reported that the Monograph on Electroless Nickel will be published in December, and will be 80–90 pages long. Dr. Saltonstall reported that his section plans to rewrite all ASTM B-8 specifications dealing with nickel, with special reference to the possibility of correlating these with SAE standards. In light of the new report of Sub III on thickness tests, W. Geissman was appointed to head a section which will review all ASTM B-8 specifications dealing with the thickness measurements. A task group is being set up to investigate the need for standards for gold and other precious metal plating.

Sub-Committee II—Performance Tests

J. D. Thomas, Acting Chairman

B. Knapp presented a report for his section, on corrosion of copper-nickel-chromium on steel (Program 4). For the first time, this year, panels on exposure at Detroit and Kure Beach were rated individually. Strong plater-to-plater differences were found, but it is not yet clear whether this is due to differences in copper or chromium plating practice, or to yet other variables. As a result, it has been decided that, in the future, tests will be much simpler, and try to cover less ground. The goal is to start at least one test per year. The next test (Program 5) will check on the importance of the thickness and nature of the chromium overlay. The under-plate will be duplex nickel, followed by 10–120 microinches of (a) conventional Cr, (b) crack-free Cr, (c) crack-free Cr, followed by conventional Cr. Exposure will be at Kure Beach and Newark. Buffed nickel panels may also be included in this program. Dr. Lowenheim reported that his group, which is checking the solderability of tin, has been using a wetting and spreading test developed by Dr. Pessel. Results after one year are confusing in that no decrease of solderability with aging has been noted. The present tests were conducted on steel, future tests will be conducted on copper and brass.

Sub-Committee III—Conformance Tests

A. Squitero, Chairman

Art DuRose reported that work on thickness tests was complete, and the report is being circulated for letter balloting. In addition to conventional thickness tests, newer instruments, such as the Magnegage, Kocour, Dermitron and Booneton gages were also investigated. In many cases, rather large between-operator and between-laboratory variations were found. Major finding is that the microscopic method is quite unreliable as a referee method. M. Mendizza reported that his group was almost ready to test Cu-Ni-Cr panels by various accelerated corrosion tests, but that work was being held up until AES Project 15 clarifies the present status of the Corrodkote test. Many members felt that this program is premature, and suggested holding up on this program until the various accelerated corrosion tests have been better standardized. G. Van Tilburg is heading up a new section which will study ductility. In addition to standard tests, two new tests which are about to be published by Dr. Read and by Mr. Romanoff will also be investigated.

Sub-Committee IV—Electroplating Practice

E. Saubestre, Chairman

B. Knapp's section has completed a proposed Recommended Practice for Plating Nickel on Nickel. This new practice covers a large number of procedures, useful under a particular set of circumstances. After lengthy discussion, some changes were made, and with these, the Practice was approved and sent on to Committee B-8 for letter balloting. Mr. Kafarski reported that his section has completed a lengthy report on Industrial Water Requirements in the Electroplating Industry. This report will now be submitted to members of Sub. IV for their consideration. Mr. W. Metzger, reporting for B. Cohen, reported on the revision of B177-55, relating to replating of chromium. Extensive changes in the report were made from the floor, and when these have been incorporated, the report will be submitted for letter balloting. A task group was appointed, under W. Safranek, to look into existing ASTM B-8 Recommended Practices, to see what additional ones are needed.

Sub-Committee V—Supplementary Treatments

E. Bertucio, Acting Chairman

A report delivered for Dr. Spring's section on phosphate coatings showed erratic results with the modified Springfield test. Three cooperating laboratories found no rust, using this test, two others found only very slight evidence of tiny rust spots. Water immersion and salt spray were found to be more useful. Since the water content of the phosphate coating is important, packaging of parts prior to testing is critical. In particular, VPI paper should not be used. Another section is about to begin testing of chromate coatings on aluminum, including both field service performance tests and accelerated corrosion tests.

Sub-Committee VI—Anodized Coatings

A. Cochrane, Acting Chairman

G. Kissin reported that a Specification for Measurement of Anodic Film Thickness on Aluminum has been completed, and will be submitted for letter ballot. A general specification covering chromic and sulfuric acid anodizing of aluminum has been prepared. However, in view of the recent doubling in size of Sub VI, it was voted that this Specification be resubmitted to the members of Sub VI for re-consideration. Another group has encountered difficulty in standardizing the Dye Test for Testing Sealing of Anodized Coatings. It is presently uncertain whether these difficulties arise from variations in test procedure, in the dye, or in the sealing methods themselves.

TENTATIVE PROGRAM
EDUCATIONAL SESSIONS

(As Tentatively Approved by Editorial Board, September 18, 1959)

MONDAY, JULY 25

2:00 p.m. — *THE SECOND ANNUAL "WILLIAM BLUM LECTURE"*
Dr. A. Kenneth Graham, Second Winner of "AES Scientific Achievement Award"

2:30 p.m. — *SESSION A*
"Statistical Analyses Applied to Plating Processes."
"Metal Finishes and Problems in the Missile Field."
"Safety in the Plating Room."

SESSION B
ORGANIC COATING SESSION
(Papers to be announced)

TUESDAY, JULY 26

9:00 a.m. — *SESSION C*
"Recent Developments in Gold Electroplating."
"Thick Gold Deposits."
"Acid Gold Plating."
"Precious Metal Plating in Printed Circuits."

9:00 a.m. — *SESSION D*
"Outdoor and Accelerated Corrosion Test Comparisons."
"Corrosion Resistance Progress Reports."
"New Procedures for Plating Zinc Diecastings."
"Effects of variation in Copper Plating on Corrosion Performance."

1:00 p.m. — *ANNUAL CONVENTION OUTING*

WEDNESDAY, JULY 27

9:00 a.m. — *SESSION E*
"HYDROGEN EMBRITTLEMENT IN METAL FINISHING" SYMPOSIUM
(Five papers to be announced)

2:00 p.m. — *SESSION F*
"HYDROGEN EMBRITTLEMENT IN METAL FINISHING" SYMPOSIUM
(Five papers to be announced)

7:30 p.m. — ROUND TABLE DISCUSSION "HYDROGEN EMBRITTLEMENT IN METAL FINISHING"

THURSDAY, JULY 28

9:00 a.m. — *SESSION G*
"A Study of Variation in Certain Characteristics of Bright Nickel Deposits with Variation in Bath Temperature."
"Magnetic Properties of Electrodeposited Cobalt Alloys."
"Sulfamate Plating Solutions of Cobalt, Iron and Cadmiun."
"Electroless Nickel."

9:00 a.m. — *SESSION H*
"Cleaning Techniques in Electronics Industry."
"Study of Anodic Coatings on Aluminum."
"Solution Transfer in Plating Barrels."
"New Method of Chrome Plating Directly on Aluminum."

2:00 p.m. — *SESSION I*
"Corrosion Problems with Decorative Chrome."
"Dual Chrome Systems."
"Chrome Plating Rifle Barrels."

LOS ANGELES CONVENTION PREPARING LIFETIME OF MEMORIES FOR AES's LADIES

One of the outstanding features of the GOLDEN JUBILEE CONVENTION held in Detroit, June 15–19, 1959 was, of course, its educational session arm, namely the Fifth International Conference on Electrodeposition and Metal Finishing, which heard 43 technical papers by experts of nine countries. And one of the principal attractions of the 47th Annual Convention of the AES that will be staged at the Statler Hotel, Los Angeles, California, July 24–28, 1960 will be an educational session program that, at this writing, is being beamed to include 37 technical papers grouped into nine sessions.

Though educational enrichment will, as always, be the main mission of the Los Angeles Convention, no AES Convention has also promised more in the way of entertainment, sightseeing and relaxational pleasures. Against the vacational background of America's West Coast "Wonder City", that, naturally, is to be expected.

Under the leadership of Ladies Chairman Dolly Beckwith, for example, a Ladies Program is being created that will long be treasured among the happiest Convention memories of the many AES Ladies expected at the Los Angeles Convention July 24–28, 1960.

In its preliminary, still incomplete and tentative form, the 1960 Los Angeles Convention's Ladies Program will lead off with a "California Welcome Tea" to be held at the handsome Statler Hotel from 3 p. m. to 5 p. m. on Sunday, July 24. The Convention's traditional "get-together" party will be staged that Sunday evening as usual.

On Monday, July 25, according to present plans of Chairman Beckwith and her industrious Ladies Committee, a Ladies Opening Session will be conducted followed by a Ladies Luncheon at the Statler. If no other afternoon event is ultimately programmed for later that same afternoon, here will be opportunity for independent sightseeing by AES's ladies of the many sights for which the "Golden City" is world famed.

Tuesday, July 26, will be the widely anticipated AES visit to Disneyland.

Then on Wednesday, July 27, the ladies will be transported by buses to the renowned Beverly Hilton Hotel. They will lunch around the famed Aqua Pool. They will view a diving exhibition. They will witness a California fashion show.

And on Thursday, July 28, they will enjoy a bus tour view of Hollywood's "Homes of the Stars", then journey to the Farmers Market, California's unique shopping center for food, gifts, clothing. They will lunch there, then see the sights or shop to their hearts' content.

The Farewell Banquet, with a top-grade bill of entertainment then dancing, will close the AES's memorable 47th Annual Convention in America's "Golden City". Los Angeles sure hopes that YOU WILL BE THERE!

Mrs. Glenwood J. Beckwith
chairman
Ladies Committee
AES 47th Annual Convention

HOW TO PACK FOR LOS ANGELES CONVENTION

Packing's no problem when you're coming to Los Angeles because you needn't prepare for climate changes while you're here. A look at the temperature and rainfall chart below and you'll understand. Bear in mind, however, that evenings in Los Angeles are always cooler, so pack for comfort. Bring sport clothes for daytime fun, and for evenings, the sort of clothing you wear at home when you're going out. You may want to bring along swim trunks, golf clubs and other sports equipment, too, because—whatever you like—it's all available in Los Angeles!

	Noon Temperature	Days of 1/100 Inch Rainfall	Inches of Rain
JANUARY	62.6	6 Days	2.92
FEBRUARY	62.6	7 Days	3.30
MARCH	65	6 Days	2.75
APRIL	66.8	4 Days	1.03
MAY	69.3	2 Days	.36
JUNE	72.7	1 Day	.08
JULY	77.9		.01
AUGUST	77.6		.03
SEPTEMBER	77.3	1 Day	.21
OCTOBER	73.8	2 Days	.62
NOVEMBER	70.8	3 Days	1.12
DECEMBER	64.6	6 Days	2.87

(Left, below) AES Ladies attending the 1960 Los Angeles Convention will lunch around this Aqua Star Pool of the Beverly Hilton Hotel on Wednesday of Convention week. This is only one of the many delightful functions planned by the Ladies Program Committee. (Right, below) The fabulous new Beverly Hilton Hotel in Beverly Hills, California, the town famous for homes of the movie stars.

MANY AES FEMALE MEMBERS HOLDING KEY BRANCH OFFICES

Since that far off day some four decades ago when Mrs. Esther Zalia Jencks Gailey (Baltimore-Washington Branch) became the first female member of American Electroplaters' Society, Inc. (AES), many female members have graced AES's Active Membership, and today many are serving their Society in important Branch positions. These, of course, are additional to the dedicated Branch ladies who have so remarkably headed the Ladies Programs of AES National Conventions or who have served on those important Ladies Committees as subchairmen or members.

Two such female AES Active Branch members are actually serving as Branch Secretaries currently, namely Miss Edna Rohrabaugh (Indianapolis Branch) and Helen Archibald (Seattle-Puget Sound Branch), with a third, Mrs. Katherine D. Christians, having served in similar capacity in the recently disbanded San Antonio Branch.

In the Sydney (Australia) Branch, Mrs. I. B. Coulson is Branch Librarian, and only last year, Mrs. Jerita D. Wilson not only served in that capacity for the Southeastern Branch, but also actually programmed and headed the outstanding Educational Sessions of the two-day GOLDEN JUBILEE Dixie Region celebration that was staged concurrently with the Sixth Interim Meeting in Atlanta, Georgia, in February 1959.

On the West Coast, Miss Alice Prescott of the Los Angeles Branch is serving as Secretary of the 47th Annual AES Convention Committee and Marjorie Farmer is Branch Librarian.

NICKEL SYMPOSIUM AT DETROIT ANNUAL MEETING

On Friday, December 4, Detroit Branch will hold its Annual Educational Session at 8 p.m. at the Statler Hilton Hotel. It will be National Officers Night and will feature a "Symposium on Nickel Plating." Panel members will be Walter L. Pinner, Dr. Henry Brown and Dr. M. M. Beckwith. Myron Diggin is to be Technical Chairman.

The following evening, December 5, the annual Christmas Dinner Party and Dance will be held. A Cocktail Party sponsored by the suppliers is scheduled for 6 o'clock. Dinner will start at 7, and at 9 p.m. there will be a floor show with the George Bailey entertainers and the Herbie Ross Orchestra occupying the spotlight. After the show, cocktails will be served in the Michigan Room until 12:30 a.m.

The dinner dance will be attended by 800 Branch members and their wives, The National Officers will be in attendance.

NEWARK CHRISTMAS PARTY ARRANGEMENTS COMPLETE

Announced plans for the Annual Christmas Party of the Newark Branch indicate the popular occasion will measure up to the high standard of enjoyment it has set over the years. It will be held at the Robert Treat Hotel, December 12.

A Cocktail Party in the McCarter Gallery at 6 o'clock, provided through the courtesy of the local members of the Metal Finishing Suppliers' Association, will start the festivities. The Banquet will commence at 7:30 in the Main Ballroom.

The entertainers will include the Vikings, a male quartet; Celeste Evans, female prestidigitator; Steve Evans, comedian and impressionist; and Howard Oliver, master of ceremonies. Music for dancing will be provided until 2 a.m.

CHICAGO FEATURES TOP AUTO MEN

January 30, 1960 is the date of the 48th Annual Meeting and Banquet of Chicago Branch at the Conrad Hilton Hotel.

The timely subject for the educational session "New Plating Specifications and Test Methods" will be presented by two topflight men in the automotive field, Cleveland F. Nixon of General Motors Corp. and Joseph Gurski, Ford Motor Company. The session is scheduled to start at 2 p.m.

A Cocktail Party from 6:15 to 7:15 p.m. will precede the banquet. A. L. Poe and D. H. Morris are this annual event's cochairmen.

SIX AES SCIENTISTS NOMINATED FOR HIGHEST ACHIEVEMENT AWARD

Six stalwarts of AES have been placed into nomination for the third annual "AES Scientific Achievement Award", the Society's highest scientific honor. The Boston, Baltimore-Washington, Buffalo, Columbus, Mohawk Valley and New Haven Branches are those who have placed those six candidates into contention for the 1959–1960 Award by deadline as per the Award's governing rules.

The "nominating form" signed by the Delegates of the respective Branches, together with six copies of statements of qualifications submitted by each Branch for its nominee, have been routed by the National Executive Secretary to the AES Scientific Achievement Award Committee for consideration and action. The winner will be announced at the Grand Opening Session of the 47th Annual Convention to be held at the Statler Hotel, Los Angeles, Monday, July 25, 1960.

Prior winners of the Award are Dr. William Blum and Dr. A. Kenneth Graham. The former delivered the first "William Blum Lecture" at the Detroit Convention on June 15, 1959. The latter will deliver the second "William Blum Lecture" at the Los Angeles Convention, July 25, 1960. The Award carries a $500 honorarium, a scroll and other recognition as reward for achievement.

The Selection Committee is headed by Dr. H. B. Linford and includes Myron B. Diggin; Dr. Abner Brenner; Dr. Russel E. Harr; Dr. Louis Weisberg and Dr. Harold J. Wiesner.

STONER AND PARISHO ADDED TO MEMBERSHIP COMMITTEE

Vacancies in the roster of the AES's Membership Committee created by the election of former Chairman Manuel Ben as AES Third Vice President, and the resignation of G. Stewart Krentel have been filled by the Executive Board.

To the unexpired term of Mr. Ben, the Board appointed George Parisho of the Mississippi Valley Branch. L. Truman Stoner of the Los Angeles Branch succeeds Mr. Krentel, also of Los Angeles.

Photographs Courtesy of Products Finishing

AES's MIDWEST REGIONAL COUNCIL CONDUCTS EFFECTIVE EDUCATIONAL CONFERENCE AT ROCKFORD COLLEGE

A large audience attended and was benefitted by the effective First Annual Regional Conference of the Midwest Regional Council held at Rockford (Ill.) College, Saturday, November 7, 1959. Featuring a forenoon Organic Workshop Session moderated by Council Chairman Leslie L. Diveley and an Inorganic Workshop Session moderated by AES National President Ralph D. Wysong, each with panels of prominent experts, the Conference also heard Dr. William Blum at luncheon. The outstanding afternoon session was moderated by Past National President Clyde Kelly. Above left, a view of the Speakers' Table at luncheon. Then a view of the popular exhibits of plated parts arranged by members of the Midwest Council. At extreme right, the morning's Inorganic Workshop Session. Conference Planning Committee Chairman was William Geissman of the Rockford Branch who headed a departmentized Committee of eleven stalwarts of respective Midwest Branches.

AES NEWS

Colonel Thurston Paul

Banquet Speaker at the Symposium, Colonel Paul has been active in Army guided missile programs for some 11 years, first as a test officer, now as Deputy Commander of the Army's organization for developing long range and space vehicles.

AEROSPACE SYMPOSIUM EXPECTED TO DRAW LARGE SCIENTIFIC AUDIENCE

Expected to draw an audience of some 500 engineers and scientists from the aircraft, missile and related industries throughout the nation, the two-day AEROSPACE FINISHING SYMPOSIUM will be held at the Hotel Texas, Fort Worth, December 8–9, 1959, jointly sponsored by the dynamic Dallas-Fort Worth Branch of American Electroplaters' Society, Inc. and the Southwest Society of Aircraft Materials and Process Engineers.

Four well-balanced technical sessions, each with a full roster of experts, will feature the Symposium, namely *Tuesday Morning* (December 8): "Metal Depositions and Plating Processes"; *Tuesday Afternoon:* "Coatings for the Future"; *Wednesday Morning:* "Special Processes and Finishing Treatments" and *Wednesday Afternoon:* "Organic Coatings and Polymeric Finishes".

Luncheon Speaker on Tuesday will be Dr. W. A. Orr of the Convair Company who will discuss, "Interesting Aspects of Space Vehicles". Wednesday's luncheon will have Dr. F. C. Jonah of the Chance Vought Aircraft Company treating, "Where We Are and Where We're Going in This World of Space".

An interesting added attraction of the heralded Symposium will be a "Finishing Forum" to be conducted on Wednesday evening comprising a panel of the speakers at the technical sessions plus several specially invited finishing authorities.

A highspot of the imaginative and well-programmed two-day meeting will be its banquet to be held Tuesday evening. Colonel Thurston T. Paul, Deputy Commander of the Army Ballistic Missile Agency, Redstone Arsenal, Alabama, will be the principal speaker. A floor show titled, "Orbiting by the Chaingang" will spectacularly conclude the evening's fare.

On Monday, December 7, an exploratory meeting is expected to be held of representatives of AES's Dallas-Fort Worth; Houston; Kansas City; Wichita and possibly Denver and Phoenix Branches targeted to the possible formation of an AES Southwestern Regional Council.

Also to be discussed that same day by interested elements of the AES Research Program and the Southwest Society of Aircraft Materials and Process Engineers will be the possible creation of a cooperative research project beamed to advancements in plating and metal finishing of aircraft and aerospace materials.

MEMBERSHIP COMMITTEE URGES MEMBERS WEAR AES LAPEL PINS

Among the projects of serious interest to the National Membership Committee this year headed by M. Lester Reynolds, also President of the Indianapolis Branch, is the popularization of the wearing of AES lapel pins by AES members of all kinds.

Consequently, each AES member is urged to purchase an official AES lapel pin from his Branch Secretary and proudly wear it.

Branch Secretaries may, in turn, purchase such silver pins from AES National Headquarters at the following prices, including tax:

Branch Past President's pin . . . . . $1.43 per pin

Branch Members pin . . . $1.38 per pin

The AES National Past President pin is gold and is given by the Supreme Society to the retiring President at the Annual Meeting upon the ending of his tenure as titular head of the Society. The AES National Officers pins (gold) are worn only by the six National Officers and are relinquished upon ending of term of office.

Fort Worth, Texas, where Aerospace Finishing Symposium will be held on December 7 and 8. The AES Dallas-Fort Worth Branch is co-sponsor of the symposium with the Southwest Society of Aircraft Materials and Process Engineers.

Miami's beachfront Saxony Hotel occupies an entire block of Florida's famed Golden Strand.

DIXIE REGIONAL TO STAGE TWO-DAY PROGRAM IN MIAMI'S ATTRACTIVE SAXONY

On the heels of its standout two-day GOLDEN JUBILEE Educational Sessions Program held concurrently with the Sixth Interim Meeting of the Supreme Society in Atlanta, Georgia, last February with the Southeastern Branch as host, the surging Dixie Region of the AES will conduct its Second Annual Regional Educational Sessions and Program at the Saxony Hotel, Miami, Florida, January 15–16, 1960, with AES's Miami Branch as host. The Dixie Region is comprised, besides Southeastern and Miami, of the Blue Ridge Branch.

Under the leadership of Branch President Marmaduke H. Dent, the versatile two-day program published in an adjacent column is being created as educational and relaxational fare for the many members of that AES region, and their families and guests, who are expected to attend. In addition, many other members of the Society, from other regions, are apparently planning to be present, including National President Ralph D. Wysong.

PROGRAM
SECOND ANNUAL DIXIE REGIONAL EDUCATIONAL MEETING
SAXONY HOTEL, MIAMI, FLORIDA
JANUARY 15-16, 1960

FRIDAY, JANUARY 15

9:00 a.m.—Registration
9:30 a.m.—Plant Tour, National Airlines and Miami International Airport
12:30 p.m.—Ladies Program. Luncheon and Fashion Show
1:30 p.m.—Opening Session and Educational Session
2:00 p.m.—Ladies & Children. Shopping, Sightseeing, Bathing (private beach, pool, cabana club available)
7:00 p.m.—Night Club Tour ($12.00 per person)

SATURDAY, JANUARY 16

9:00 a.m.—Registration
9:30 a.m.—Educational Session
10:00 a.m.—Ladies & Children. Shopping, Bathing, Sightseeing Tour (guided) including Gold Coast and Miami Seaquarium
2:00 p.m.—Educational Session
6:15 p.m.—Saxony Cocktail Party
7:00 p.m.—Farewell Banquet and Floor Show

SPEAKERS:

Among these will be Dr. Henry L. Kellner, Lea Manufacturing Co.; Dr. Samuel Spring, Kelite Co.; Dr. E. J. Seyb, Metal & Thermit Corp.; Dr. M. M. Beckwith, Harshaw Chemical Co.; A. Korbelak, Sel-Rex Corp.; Others.

HOTEL ACCOMMODATIONS:

Convention Rates apply at the Saxony.

YOUR WIFE MAY WANT TO READ YOUR PLATING

Just in case you overlooked the last paragraph of the piece in "Branch News" (October PLATING, p. 1212) by Edna Heavens, Publicity Chairman of the Ladies Auxiliary, Detroit Branch, it is presented here for your serious consideration:

"Now to you men who receive PLATING MAGAZINE at your office, won't you please take it home so your wife can read it. . . . I find it quite interesting, maybe your wife will too. You will be surprised to find out how much it helps keep closer to the friends you see only once in a while."

AUSTRALIA'S BRANCH LIBRARIANS

MELBOURNE:
G. Allen, 10 Winwood Street, East Ringwood, Victoria, Australia

SYDNEY:
(Mrs.) I. B. Coulson, 52 Nicholson Street, Chatswood, New South Wales, Australia

THREE EDUCATIONAL COMMITTEE STALWARTS REAPPOINTED BY BOARD

Reappointed by the Executive Board to the AES Educational Committee for three-year terms retroactive to June 15, 1959 are Ralph M. McCahan (Hartford Branch); Myron Ceresa (Pittsburgh Branch) and Dr. Ernest J. Wilhelm (St. Joseph Valley Branch). Board action in this connection was taken at its Detroit, Michigan, meeting of September 12, 1959.

TENTATIVE PROGRAM

FIFTIETH ANNIVERSARY, PHILADELPHIA BRANCH
AND
SEVENTH INTERIM MEETING, SUPREME SOCIETY

BEN FRANKLIN HOTEL, PHILADELPHIA
FEBRUARY 18-21, 1960

THURSDAY, FEBRUARY 18
9:30 a.m.—AES Research Committee Meeting (All Day)

FRIDAY, FEBRUARY 19
9:00 a.m.—AES Executive Board Meeting (All Day)
10:00 a.m.—Registration, Branch Fiftieth Anniversary
2:00 p.m.—Plant Tour (Sellersville Plant, American Machine & Metals Co.)
6:00 p.m.—Dinner (Dutch Treat)
7:30 p.m.—GRAND OPENING Session, Branch Fiftieth Anniversary
8:00 p.m.—Educational Session "A"
"Chromium Solutions" by Arthur W. Logozzo, Nutmeg Chrome Plating Co.
"Remedies for Corrosion of Nickel Chromium Coatings" by Dr. W. A. Wesley, International Nickel Co.
9:00 p.m.—Joint Meeting, Executive Board, American Electroplaters' Society and Board of Trustees, Metal Finishing Suppliers' Association

SATURDAY, FEBRUARY 20
8:00 a.m.—Registration, Branch Fiftieth Anniversary
8:00 a.m.—Registration, Delegates/Alternates, AES Supreme Society
10:00 a.m.—Seventh Interim Meeting, Supreme Society
10:00 a.m.—Educational Session "B"
"Hard Anodizing" by Dr. Harold J. Wiesner, Bendix Aviation Co.
"Anodizing and Chemical Finishes" by Russell VandenBerg, Aluminum Company of America
"Plating on Aluminum" by William K. Murray, Enthone, Inc.
1:00 p.m.—Seventh Interim Meeting Luncheon (Dutch Treat)
2:00 p.m.—Seventh Interim Meeting, Supreme Society
6:00 p.m.—Fiftieth Anniversary Cocktail Hour
7:00 p.m.—Fiftieth Anniversary Banquet and Floor Show

SUNDAY, FEBRUARY 21
9:00 a.m.—AES Executive Board Meeting

HOST: AES PHILADELPHIA BRANCH

INTERIM MEETING REPORTER

BEN FRANKLIN HOTEL PHILADELPHIA, PA. FEBRUARY 20, 1960

UNIQUE INTERIM MEETING AND PHILADELPHIA FIFTIETH ANNIVERSARY PLANS SURGING

Elaborate plans are rapidly being developed in the AES's Philadelphia Branch for a memorable observance of its Fiftieth Anniversary to be held over a two-day span at the Ben Franklin Hotel, Philadelphia, February 19–20, 1960, concurrently with the SEVENTH INTERIM MEETING of the Supreme Society.

Five experts will discuss timely technical subjects at two Educational Sessions, namely AES Past President Arthur W. Logozzo, William K. Murray, Russell VandenBerg, Dr. W. A. Wesley and Dr. Harold J. Wiesner. The sessions will be conducted Friday evening, February 19 and Saturday morning, February 20. A tour of the new Sellersville Plant of the American Machine & Metals Co. is programmed for Friday afternoon.

Ben Franklin Hotel, Philadelphia

The Supreme Society meeting will start at 10 a.m. and will continue to late afternoon adjournment, with recess for a "Dutch Treat" luncheon at 1 p.m. Then will come the Cocktail Party sponsored by the Metal Finishing Suppliers' Association—followed by the gala Farewell Banquet, Floor Show and Dance. A Ladies Program is also in contemplation. Reportedly, the over-all registration fee will total $10 per person.

In the conduct of this ambitious program, Branch President James E. Cogan Jr., as General Chairman, is being assisted by a galaxy of industrious Subchairmen including Dr. Samuel Heiman and Joseph Berenato (Educational); Kenneth W. Clayton (Program); Irvin K. Hauseman (Publicity); Donald H. Marsh (Tickets and Table Reservations); Edward M. Hoffman (Registration); I. William Marcovitch (Plant Visit); William Brown (Cocktail Party); William H. Trusdell (Hospitality and Welcome); William Moyer (Hotel Liaison); Jack Ross (Entertainment); David Thomas (Door Prizes); Vincent L. Caswell (Ladies Program) and Paul Metzger Sr. (Finance).

INTERIM MEETING HOST BRANCH COMMITTEE CHAIRMEN MEET

Interim Meeting plans were discussed at the Ben Franklin Hotel, Philadelphia on October 19. (Left to right) David Thomas Jr., Paul Mentzer Sr., Irvin K. Hauseman, Robert L. Farren, W. H. Moyer, National Executive Secretary John P. Nichols, Branch President and General Chairman James E. Cogan Jr., I. William Marcovitch, W. H. Brown, Vincent Caswell, Joseph Berenato Jr., Edward M. Hoffmann Jr., Walter W. Gleadall and Kenneth W. Clayton.

TENTATIVE AGENDA

SEVENTH INTERIM MEETING AES SUPREME SOCIETY

BEN FRANKLIN HOTEL, PHILADELPHIA, PA.
FEBRUARY 20, 1960

1. Welcome by Philadelphia Branch
2. Welcome by National President and Congratulations to Philadelphia Branch on its Fiftieth Anniversary
3. Opening of the Session as an Interim Meeting
   Purpose of the meeting as a sounding board on matters for subsequent consideration and action by the Supreme Society at its Annual Meeting in Los Angeles, July 28, 1960
4. Progress and Status Reports:
   Financial by President
   Educational by First Vice President
   Membership by Second Vice President
   Branch Regionalization, Regional Annual Meetings and Branch Convention Exhibits as Tools of AES Educational Mission by Third Vice President
   Honorary, Merit and Achievement Awards as Inducements for Greater AES Service by Immediate Past President
   Headquarters and AES Publishing and Public Relations by National Executive Secretary
   AES Research Program by Chairman, Research Committee
5. Preliminary Reports:
   a) Executive Board Appraisal as to AES Investments
   b) Executive Board Recommendations for AES Constitutional and/or Bylaw Amendments If Any
6. Comments and Questions from the Floor:
   a) Membership Promotion (Membership Committee Chairman, Discussion Leader)
   b) Sustaining Member Promotion (Vice Chairman for Finance, Research Committee, Discussion Leader)
   c) Book Publishing (Publications Committee Chairman, Discussion Leader)
   d) Branch Educational Sessions (Chairman, Public Relations Committee, Discussion Leader)
7. AES National Conventions and Interim Meetings
   a) 1960 Los Angeles Convention (Los Angeles Convention General Chairman)
   b) Other AES National Conventions Ahead
   c) Seventh Interim Meeting, Philadelphia (General Chairman)
   d) Eighth Interim Meeting, Hartford (New England Region Representative)
   e) Report of Outcome of Golden Jubilee Convention and Industrial Finishing Exposition, including Fifth International Conference on Electrodeposition and Metal Finishing (Executive Board)
   f) Proposed Dates for AES's Next Industrial Finishing Exposition
8. New Business Brought For Discussion by Delegates
9. Announcement of Candidates for Third Vice Presidency
10. Adjournment

Phoenix Branch's leadership viewed with AES installation team. (First row, left to right) National Executive Secretary John P. Nichols, Branch President William Griff, National President Ralph D. Wysong. (Rear rows) Branch Secretary James Weaver, D. Hill, Board of Managers, Treasurer John Mullarkey, Librarian Paul Wilbe, Third Vice President Paul Madden, First Vice President Floyd Huhn, Second Vice President Robert Axson and Dr. Clyde A. Crowley, Board of Managers.

Arizona's Governor Paul Fannin welcoming AES and its Phoenix Branch. (Left to right) Mr. and Mrs. Griff, Dr. and Mrs. Crowley, Mr. and Mrs. James Weaver.

The dais at the Phoenix Branch's installation, Valley Ho Resort Hotel, Scottsdale, Arizona, October 9, 1959. Mayor and Mrs. Jack Williams of Phoenix at extreme left. Dr. Crowley at lectern.

GOVERNOR AND MAYOR PARTICIPATE IN PHOENIX BRANCH'S INSTALLATION PROGRAM

In the presence of Governor Paul Fannin of Arizona, Mayor John R. Williams of Phoenix and other civic and metal finishing industry dignitaries present, AES's new Phoenix Branch was officially installed as a permanently chartered Branch of the American Electroplaters' Society by an installation team composed of National President Ralph D. Wysong and National Executive Secretary John P. Nichols. The ceremonial meeting of Phoenix Branch members and their families and guests was held at the famed Hotel Valley Ho, Scottsdale, Arizona, Friday, October 9, 1959.

With Dr. Clyde A. Crowley, Chairman of the Chemistry Board of Arizona State University as Toastmaster, the evening's program was opened with the addresses of welcome of Governor Fannin and Mayor Williams. Branch Secretary James Weaver next presented the background and chronology of the formation of the Phoenix Branch.

The impressive installation ceremony then occurred following which National President Wysong, in behalf of the Board, pronounced the Branch officially admitted as a chartered AES Branch. He also installed into office the Branch's first permanent officers. These include William Griff, President; Floyd Huhn, First Vice President; Robert Axson, Second Vice President; Paul Madden, Third Vice President; John Mullarkey, Treasurer; James Weaver, Secretary and Paul Wilbe, Librarian.

The Branch's acceptance of its permanent charter was made by Branch President Griff, and each speaker was presented with symbolic cuff links, courtesy of the Motorola Company. The meeting was followed by dancing to music by the Frank Pratt Orchestra.

By virtue of the Executive Board's recent revocation of the San Antonio Branch's charter and its acceptance of the resignation of AES's former Twin City Branch, the new Phoenix Branch became the Society's 57th Branch, with the new Denver Branch installed October 13 becoming AES's 58th Branch.

Viewed Phoenix Branch's table display.

COLORADO ATTORNEY GENERAL WELCOMES DENVER BRANCH AT AES INSTALLATION

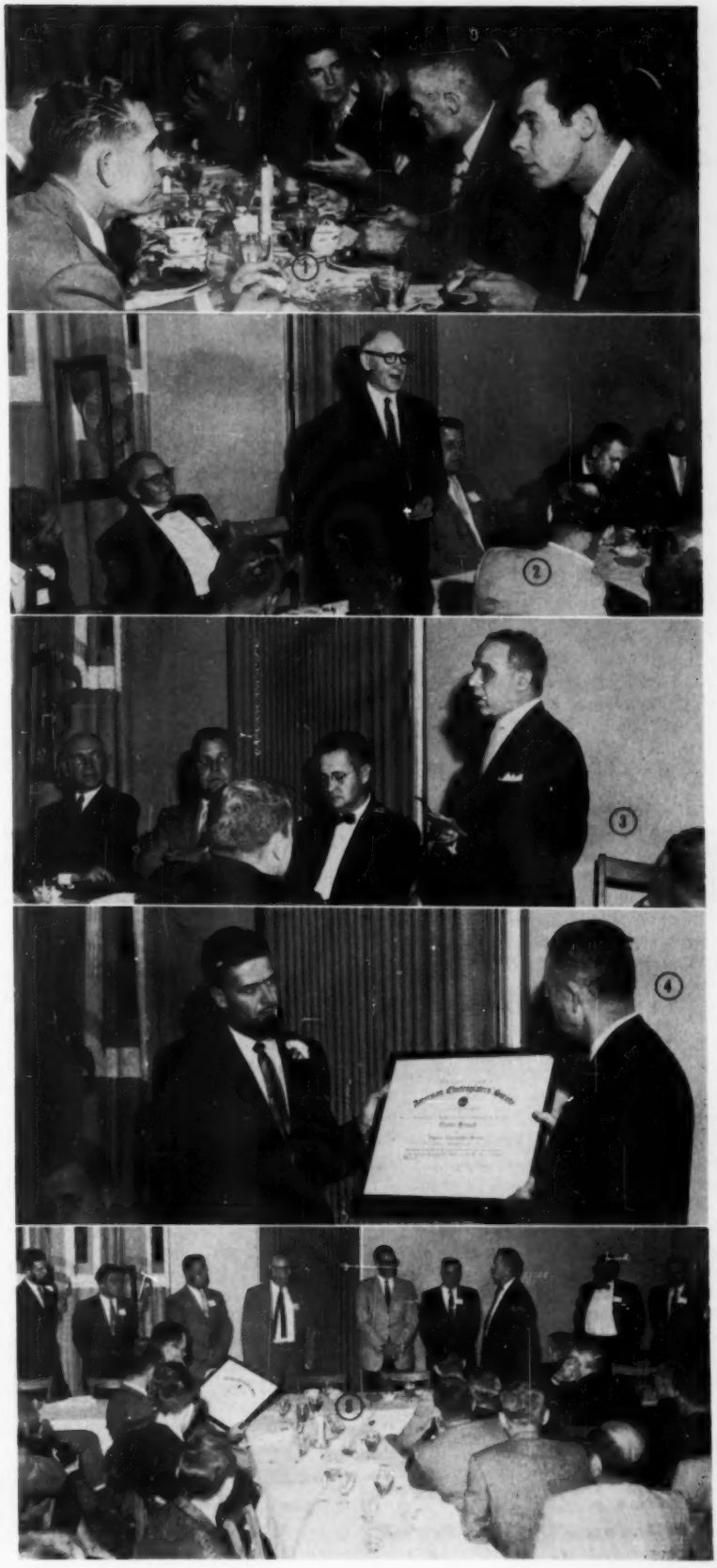
The Denver Branch was presented with its framed permanent charter and officially installed by National President Ralph D. Wysong at a memorable installation meeting held at Writers Manor, Denver, Colorado, Tuesday, October 13, 1959. It consequently became the 58th permanently chartered Branch of American Electroplaters' Society, Inc. (AES).

Aside from President Wysong, National Executive Secretary John P. Nichols, who also composed the Executive Board's installation team, and Attorney General Duke W. Dunbar who represented Colorado's Governor in extending the State's official welcome, the outstanding meeting was attended by Branch President Robert D. Martin and all other Branch officers and members, plus an array of distinguished guests.

Toastmaster Dwayne Poucher, Branch Second Vice President, was introduced by Branch President Martin, and he presided. After introduction of guests, he called upon Attorney General Dunbar who extended the State's official welcome in behalf of State and municipal government.

Board of Managers Chairman Owen T. Towner next presented a well-received history of the fledgling Branch. National Executive Secretary Nichols then oriented the Branch, readied it for installation, and National President Wysong installed it. The President also installed the Branch's 1959–1960 officers, and indoctrinated its elected Delegates and Alternates. The meeting closed with a lively question and answer period.

Installed Branch Officers beside President Martin include First Vice President Richard Venier; Second Vice President Dwayne Poucher; Secretary Phillip London; Treasurer Robert Whyman and Librarian Harry Schoonover. Besides Chairman Towner, the 1959–1960 Board of Managers includes Hubert Pahlow and James Jenkins.



(1) Part of the large gathering that attended the AES Denver Branch installation, October 13. (2) Colorado's Attorney General Duke Dunbar welcoming AES and its new Denver Branch to the State and City. Left to right Branch President Robert D. Martin; Denver Board Chairman Owen Towner; Toastmaster Duane Poucher; National President Ralph D. Wysong and National Executive Secretary John P. Nichols. (3) National Executive Secretary indoctrinates the new Branch. (4) National President presents AES framed charter to Denver Branch via Branch President Martin. (5) National President Wysong installs Denver Branch's first officers (left to right) President Martin; First Vice President Richard Venier; Second Vice President Duane Poucher; Secretary Philip London; Treasurer Robert Whyman; Librarian Harry Schoonover; Board of Managers: Owen Towner, Herbert Pahlow and James Jenkins.

INTERSOCIETY NEWS

NACE CORROSION SHOW SPACE SOLD OUT

All available booth space was taken seven months in advance of the 1960 Corrosion Show to be presented by National Association of Corrosion Engineers, March 15–17, in Dallas. The show is being held in conjunction with the 16th Annual NACE Conference.

Eighty-eight firms will exhibit various methods of preventing corrosion in many industries.

Corrosion prevention by means of paints and coatings, cathodic protection, inhibitors, and corrosion resistant materials will be shown and demonstrated. Instruments for the detection and measurement of corrosion will also be on display.

Information concerning the 1960 and future NACE corrosion shows may be obtained by writing R. W. Huff, National Association of Corrosion Engineers, 1061 M & M Building, Houston 2, Texas.

PLANT MAINTENANCE CONFERENCE AT PHILADELPHIA

Seventy-one speakers will address the 11th Plant Maintenance & Engineering Conference at Philadelphia in January. The conference is held annually in conjunction with the Plant Maintenance & Engineering Show. Both will take place at Convention Hall, Philadelphia. The show's dates are Jan. 25 to 28 and the conference, Jan. 25 to 27.

PLASTICS ENGINEERS ELECT NEW OFFICERS

At its Oct. 26 meeting of the National Council, the Society of Plastics Engineers elected its national officers for 1960. The new officers will be installed during the Society's 16th Annual Technical Conference to be held the week of Jan. 11, 1960, at the Conrad Hilton Hotel, Chicago.

George W. Martin, new national president is president and general manager of Holyoke Plastics Corp., Holyoke, Mass. He attended the University of Connecticut. A member of SPE since 1947, Mr. Martin has long been active in society affairs, having held many offices in the Western New England Section; SPE national secretary 1958; first vice president, 1959.

Frank W. Reynolds first vice president-elect is manager, Plastics Laboratory, IBM Corp., Endicott, N. Y. An SPE member since 1950, he attended Cornell. Active in both Section and National affairs, Mr. Reynolds is the 1959 National Secretary.

Haiman S. Nathan, elected to the second vice presidency, is president of Atlas Plastics, Inc. A graduate of Cornell (BChE) and an SPE member for 14 years, he has held many section and national offices.

James R. Lampman, new national secretary, is now manager, organic chemical engineering, Materials and Process Laboratory, General Electric Co., Syracuse, N. Y. He is a graduate of Michigan State and an SPE member since 1955.

Joseph B. Schmitt, elected national treasurer, is polystyrene product manager, Plastics Division, Koppers Co., Pittsburgh, Pa. A graduate of the Missouri School of Mines, he became an SPE member in 1953 and has subsequently held many offices in the Pittsburgh Section.

ZINC INSTITUTE PLATING SYMPOSIUM

The automotive industry expressed its opinions on the importance of zinc die castings in American auto production at a plating symposium on Nov. 11 and 12 at Detroit's Statler Hilton Hotel

Conducted under the auspices of American Zinc Institute, Inc., the symposium included discussions of recently improved electroplating techniques for zinc die castings of special relevance to the automotive and appliances industries by representatives of major plating firms as well as independent research scientists.

The plating symposium convened in open session the afternoon of the first day with John L. Kimberley, executive vice president of AZI, presiding. Features of the opening session included a description of "Studies of Duplex Nickel Plating," by M. M. Beckwith, manager, Electroplating Division, Harshaw Chemical Co.; a talk on "The Role of Chromium in Protecting Zinc Base Castings," by Henry Mahlstedt, product manager, plating products, Metal & Thermit Corp.; a discussion of the "Correlation of Outdoor Exposures, Service and Accelerated Tests on Chromium Plated Bright Work," by R. B. Saltonstall, technical director of the Udylite Corp.; and a description of "The Contributions of Nickel and Chromium to the Durability of Decorative Plating," by C. H. Sample, supervisor of electroplating, The International Nickel Co., Inc.

The symposium reconvened in open session the next morning, under the chairmanship of E. A. Anderson, chief of products application, The New Jersey Zinc Co. (of Pa.), Palmerton, Pa. Speakers included M. R. Caldwell, manager of electroplating and finishes, Doehler-Jarvis Div. of National Lead Co.; David Morganstern, president of Nelmor Manufacturing Co. W. H. Safranek and C. L. Faust, research scientists of Battelle Memorial Institute, described American Zinc Institute research currently underway at Battelle on the improvement of finishes for zinc die castings.

The Thursday final session of the symposium was closed with W. L. Pinner, manager of electroplating development, The McGean Chemical Co., presiding. Representing the automotive industry was D. M. Bigge, managing engineer of Chrysler Corp.; C. F. Nixon, head, electrochemistry, General Motors Corp. Research Laboratories; J. T. O'Reilly, assistant manager, process development department manufacturing staff, Ford Motor Co., W. S. Snyder, chief metallurgist, American Motors Corp.; and R. D. Wysong, manager, Manufacturing Research Division, Studebaker-Packard Corp., and president of the AES.

ASME ANNUAL MEETING HIGHLIGHTS NEW DEVELOPMENTS

An estimated 4500 engineers descended on Atlantic City, N. J., late in November for the annual meeting of The American Society of Mechanical Engineers, to discuss the latest developments in hundreds of fields, ranging from rocket ships to textiles. Over 300 technical papers and discussions were crowded into the week long sessions, which required use of both the Chalfonte and Haddon Hall Hotels on the Atlantic City Boardwalk.

Air pollution, hi-fi radar, plastic pipe and solar air-conditioning were discussed. Other sessions dealt with rocket ships for manned space travel, new types of ships that "fly" above the water, and new and better artificial hands for amputees.

The meeting also marked the installation of new national officers of the Society, including incoming president Walker L. Cisler, president of Detroit Edison Co.

Among featured speakers was Lieutenant General James M. Gavin, formerly director of U. S. Army Research and Development, now vice president of Arthur D. Little, Inc., Cambridge, Mass. His topic was "The Challenge of the 60's."

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OAKITE RUSTRIPPER—for removing heavy rust, paint, soil, scale. Combining alkaline detergency with "pickling" action, Rustripper has a wide variety of applications: salvaging used parts, electrocleaning, precleaning, paint stripping. It won't etch machined surfaces, avoids possibility of hydrogen embrittlement.

OAKITE COMPOSITION 24—for heavy duty cleaning to remove grease and dirt. An alkaline cleaner for hot soaking iron and steel, Oakite 24 has excellent penetrating and suspending action . . . thorough rinsing leaves heavily soiled parts exceptionally clean. Good resistance to contaminating effects of dirt.

OAKITE COMPOSITION 77—for removing carbonaceous soils and light rust. Featuring long cleaning life and a steady pH range for best action, Oakite 77 is a heavy duty cleaner which produces excellent results in removing burnt-on soils and light rust bloom.

OAKITE ALUMINUM CLEANER 164—for non-etch aluminum cleaning. Completely safe for aluminum, this alkaline material quickly removes identification inks, oils and light shop soils. It's free-rinsing, works well in hard water. Has low foaming tendencies in air-agitated tanks.

OAKITE COMPOSITION 90—for complete magnesium cleaning. Thoroughly safe for magnesium, Oakite 90 won't react with the metal surface to form insoluble soap films. It cleans completely, rinses off freely.

OAKITE COMPOSITION 20—for fast removal of medium soils. When shop soils are only moderately heavy, Oakite 20 emulsifies and suspends them in short order —most economically. An alkaline material, it offers long life and steady cleaning ability.

OAKITE COMPOSITION 23—for cleaning zinc die castings. Cleaning action of Oakite 23 avoids dullness under the electroplate found when deep-etching cleaners are used. Oakite 23 rinses film-free, leaves a bright surface that takes a smooth, bright electroplate.

OAKITE COMPOSITION 27—for non-tarnish cleaning of brass. Oakite 27 removes smuts and soils from brass and other copper alloys without tarnishing the metal surface . . . leaves parts gleaming bright. Provides the long cleaning life typical of alkaline materials.

OAKITE COMPOSITION 8—for tough pre-cleaning jobs. Used with kerosene, Oakite 8 digs into tough, tenacious soils, and heavy grease or oil. By removing the worst deposits prior to alkaline cleaning, Oakite 8 keeps total cleaning time short, cuts overall cleaning cost.

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INDUSTRY NEWS

J. Merle Hosdowich (left), has retired after 35 years' service with Metal & Thermit Corporation. He was presented with an electric portable typewriter by H. D. McLeese, vice president in charge of marketing. Mr. Hosdowich joined the company in 1923.

SEL-REX ESTABLISHES NEW WEST COAST OFFICES

Sel-Rex Corp., with executive offices located in Nutley, N. J., has established a new West Coast Office at 2180 Colorado Avenue, Santa Monica, California, a suburb of Los Angeles. The new offices reportedly provide expanded facilities for additional personnel and warehousing of precious metals processes and equipment, offering efficient handling and prompt deliveries to Sel-Rex customers in the area.

W. H. Walczyk

Walter H. Walczyk, formerly chief chemical engineer, Remington-Rand Univac (engineering development section) who was recently appointed West Coast representative, has been assigned the additional responsibility of heading-up all Sel-Rex sales and service activities in the area, according to the announcement.

It is reported that Mr. Walczyk's background in the development and manufacture of printed circuits has necessitated almost constant traveling along the West Coast, since his arrival, because of the heavy concentration of electronic industries and their interest in printed circuitry.

UDYLITE CELEBRATES FORTIETH BIRTHDAY

Forty years of business and thirty-two years of operating in the state of Michigan were completed on November 11 by the Udylite Corporation. The anniversary was celebrated with the official announcement of new $600,000 facilities for manufacture of organic chemicals at its subsidiary, the Udylite Research Corporation, 21441 Hoover Road, in Warren, Michigan, a suburb of Detroit.

Official date for the birthday, according to Clyde H. Reeme, president, is November 11. On that date in 1919, Hon. William O. Roach, then Secretary of State for Indiana, signed incorporation papers for the Udylite Process Company.

Eight years later, the company, founded by Marvin J. Udy, moved to Detroit in order to serve its customers better in the Michigan industrial area. The corporate name was changed to the Udylite Company in 1933, and to the Udylite Corporation in 1939 when the business became officially incorporated under its present title.

The company is now engaged in a diversity of business in addition to its original line of electroplating equipment and processes. Through subsidiaries it is now a factor in the field of foundry supply, in the sale of agricultural and industrial chemicals on the West Coast, and in the fields of ceramics and building supply.

DEDICATION CEREMONIES MARK NEW CHAMBERLAIN LABORATORIES

Chamberlain Laboratories, the new research and development center of The U. S. Stoneware Co., Stow, Ohio was formally dedicated on Sept. 29 as a feature of U. S. Stoneware's Centennial celebration.

Ceremonies marking the event included an "open house" at Chamberlain Laboratories, which gave visiting representatives of science, industry and the press an opportunity to inspect the new facilities, followed by a dinner in nearby Akron, Ohio. Principal speaker of the evening was Dr. Foster Dee Snell, president of Foster D. Snell, Inc., who spoke of "Research Over Nearly Four Decades." Short talks were also given by Dr. Walter J. Murphy, editorial director of the various American Chemical Society publications, and Dr. Paul Bachman, vice president and director of research of Koppers Co., Inc.

CUSHMAN ISSUED FRANCHISE BY SCHAFFNER MFG.

The Schaffner Mfg. Co., Inc. of Pittsburgh has issued a franchise to George A. Cushman covering the distribution of its products in Western Wisconsin, North and South Dakota, Iowa and Minnesota.

Mr. Cushman is the president of the Sterling Machine and Supply Co. located at 1179–15th St., S.E., Minneapolis 14, Minn. He has been in business in that area for 20 years, maintaining warehousing facilities for plating chemicals and buffs and buffing compositions.

SPEAKERS ANNOUNCED FOR NEW YORK ANNUAL

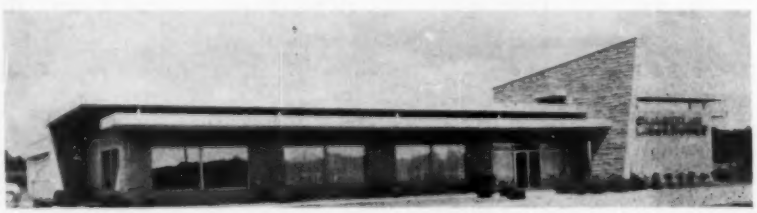
The annual Educational Session of the AES New York Branch will be held on Saturday, February 6, 1960 at the Statler-Hilton Hotel in New York City.

The speakers for the technical session will be:

Dr. R. B. Saltonstall, The Udylite Corp., whose subject will be "The Role of Agitation in Plating;" Dr. J. G. Beach, Battelle Memorial Institute, presenting "Plating on the Less Common Metals;" and Ronald Row of Metal & Thermit Corp., who will talk on "Duplex Chromium Plating."

This year, while the men are attending the technical session which begins at 2 p.m., the ladies are invited to a bingo party. Many gifts have been selected, and it promises to be a fun-filled afternoon.

The dinner-dance is set for 7 p.m. at the Terrace Ballroom. New York Branch always has excellent entertainment.



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STAMPINGS • CASTINGS • FORGINGS • SPINNINGS

Stainless steel is harder than carbon steel commonly used for forming and on most occasions more time is required to produce a selected finish on stainless steel than the same finish on steel. However, for normal application, the same general procedures are utilized.

Although much progress has been made in the finishing of stainless steels and carbon steel, the production of mirror and high luster finishes is still not easy and the costs are fairly high. On the other hand, attractive semi-bright satin and butler finishes can be obtained at a cost no greater than that required for producing this same finish on other metals. Today, satin or butler finishes are produced on a wide variety of steel or stainless steel articles, the choice being due to the great difference in the cost of production between this type of finish and the high luster finish. Some of these steels, both carbon and stainless, undergo work hardening and physical transformation at relatively low temperatures, thereby complicating polishing and buffing operations.

POLISHING...Polishing is usually done on sewed muslin, canvas, solid leather, sheepskin or felt wheels or abrasive belts at speeds of 6000-8000 sfm. Sometimes five or six polishing operations are employed. The shallower the surface imperfections are, the less coarse need be the first wheel operation and the easier the subsequent removal of scratches left by this wheel. On fairly good surfaces, only one or two of the polishing wheel operations should be necessary. For some types of stainless steel and steel products these operations may be considered a final finish. Polishing wheels may be prepared with **Lea Gripmaster Polishing Wheel Cement** or **Lea Plasti-Glue** and loose abrasives. Liquid **abrasive mixtures** such as **Leabrament** or **Lea Plasti-Brade** are also used in preparing polishing wheels. Lubrication or greasing a polishing wheel or belt can be done with **Lea Lubar** (bar lubricant) or **Lea Liqualube** (liquid lubricant).

FLEXIBLE POLISHING...On curved or irregular surfaces of steel, or stainless steel, flexible polishing with **Grade "E"** or **Grade "E2" Lea Compound** at 6000 sfm on a sewed buff sized with **Ad-Lea-Sive** is used in place of conventional fine set-up wheels to prepare the surface for subsequent cut-down buffing.

SATIN FINISHING...To produce a final satin finish on articles fabricated from rolled stainless steel with good surface characteristics, **Grade "E"** or **Grade "N" Lea Compound** is used on a loose or pocketed type muslin buff at 4500-5500 sfm. In fabricating products from pre-finished stainless steel having standard mill finishes, welded or formed areas sometimes require a coarse satin finish to simulate or blend in with the mill finish. **Lea Greaseless Compound Grades 1-K-2 or 1-K-7** are used with **Lea String Wheels** to simulate #3 or #4 mill finishes.

BUTLER FINISHING...To produce this final finish showing no surface defects, use **Grade "B-31" Lea Compound** with **Grade 316 Learok** as a lubricating agent on a sewed, loose or pocketed type muslin buff at 5500 sfm.

BRIGHT FINISHING—(Bar Compositions)...After intermediate flexible polishing with **Lea Compound,** a bright-finish is produced with **Grade 306** or **316 Learok** on a pocketed type buff at 10,000 sfm. For color, use **Grade 302C** or **309 Learok** on the same type wheel and at the same speed.

BRIGHT FINISHING—(Liquid Compositions)...After intermediate flexible polishing with **Lea Compound** or if the stainless steel has a surface in fairly good condition to serve as a base for bright finishing, **Lea Liquabrade** is used.

Grades FH77J or UF47J Liquabrade will cut down minor imperfections and give some color. **Grade 7370 Liquabrade** is for cut and color and recommended where fairly bright finishes are required.

Grade UH20A Liquabrade gives the highest color and is generally used for the last buffing operation.

Speeds of 8000 to 10,000 surface feet per minute are recommended. Ventilated, sewed or loose buffs can be used.

BLENDING AND SIMULATING MILL FINISHES ON STAINLESS STEEL

One current production method for blending in weld marks and removal of tool or die marks is as follows:

The weld bead is first ground down with a #4 grit disc, then with a portable belt machine using an 80 grit belt. The area around the weld is then finished to simulate a #4 mill finish and is produced with **Grade 1-K-2 coarse grit Lea Compound** on a 6" dia. string wheel operated by a heavy duty flexible shaft machine. **Lea Compound** is applied to the string wheel and allowed to dry approximately 5 minutes. The string wheel is then placed against the surface of the stainless steel in a straight line motion to keep the scratch pattern as uniform as is possible. The final operation involves the use of a polishing log made up of **Lea String Wheels** making a total face width of approximately 24". These string wheels are mounted on a shaft with ball bearing handles. After **Grade 1-K-2** is applied to the polishing log, coated thoroughly and dried adequately, two men hold the polishing log and satin finish the entire surface on large areas of the stainless steel item in **one uniform operation.** This **Lea Satin Finish** produced with **1-K-2 Lea Compound** directly on the original 2-B mill finish simulates quite closely the desired #4 mill finish. A periphery speed of 1350 surface feet per minute is used.

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Over the years Lea-Ronal has gained world-wide recognition for its research on cyanide copper plating. From this research and development have come numerous processes, each with its own characteristics that make it outstanding for a specific type of operation. Every member of this Lea-Ronal family of Cyanide Copper Processes has been thoroughly production-tested and has been instrumental in improving the quality and production of the user's plating operation.

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for bright high speed copper

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For plating buffed zinc die castings or steel where maximum leveling or hiding is not a factor.

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for buffable copper

CUPRALL

A lustrous, ductile, buffable copper than can be plated at high speeds. Because of these characteristics and its exceptional tolerance to impurities, this bath has become the standard for such operations as bumper refinishing.

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Q-STRIKE

A cyanide copper strike developed to aid in "hiding" surface imperfections that are not covered by conventional strikes or bright copper processes. Will increase hiding and leveling when used as a strike prior to bright nickel.

for micro-leveling and lustre

Q-LEVEL

A new improved economical and simple cyanide copper process that offers a definite degree of leveling or hiding without employing current reversal cycles. Imperfections in castings can be partially or completely hidden (Leveling is achieved on surface roughness not exceeding 10 RMS).

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A Q-Level Bath specifically designed for air agitation. Offers all the advantages of the Q-Level Process plus increased rates of deposition, and excellent metal distribution.

for leveling plus high rates of deposition

PR-Q-LEVEL

A Q-Level Bath designed to operate with Periodic Reverse. In addition to the high rates of deposition, macro-leveling as well as micro-leveling can be achieved. Process is simple, economical, completely stable with no deterioration of brighteners over prolonged operating periods.

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Electroplating Engineering Handbook.... Edited by A. Kenneth Graham. 650 pages.	$10.00	$ 6.00
Principles of Electroplating and Electroforming..... by William Blum and George B. Hogaboom. 455 pages.	8.00	6.95
Modern Electroplating..... by Allen G. Gray. 563 pages.	9.50	8.25
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Analysis of Electroplating and Related Solutions—2nd edition, 1958..... by K. E. Langford. 423 pages.	9.00	7.20
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Electrochemistry—Principles and Applications..... by E. C. Potter.	10.00	8.35
Handbook of Practical Electroplating..... by Thomas M. Rodgers.	8.50	7.10
Electroplating for the Metallurgist, Engineer and Chemist..... by J. B. Mohler and H. J. Sedusky. 257 pages.	5.00	4.50
Surface Treatment and Finishing of Aluminum and its Alloys..... by S. Wernick and R. Pinner	13.25	11.95
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Hot Organic Coatings. 225 pages..... by Raymond B. Seymour.	7.50	6.25
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Coated Abrasives—Modern Tool of Industry..... Coated Abrasives Manufacturers' Institute.	8.50	7.10
ASME Handbook—Metals Engineering Processes..... Edited by Roger W. Bolz	13.50	11.25
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44th Annual Technical Proceedings, American Electroplaters' Society—1957. Convention papers plus discussions...	10.00	10.00
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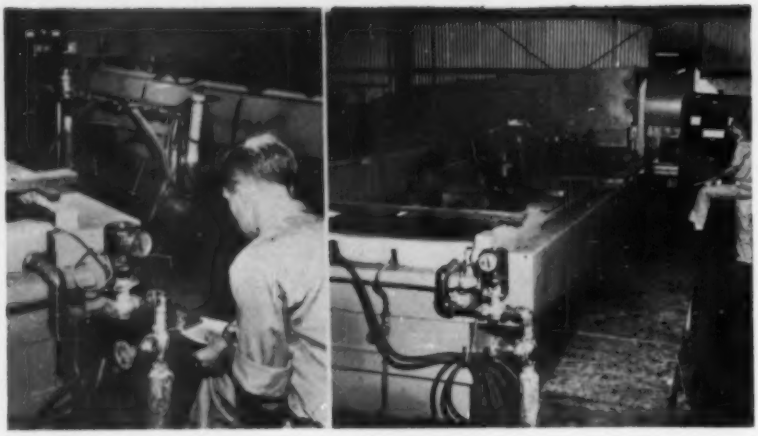

(Left) Checking self-operating regulator. The control regulates the amount of hot water at 190F allowed through a coil in the tank to maintain the chromic acid solution at a constant temperature. No outside power source is required for the regulator, thus safeguarding against failure of the control power source. **(Right)** An entire plating tank at Chrome Crankshaft Company, Inc., Los Angeles, California. Crankshaft in tank is rated on a rotary fixture. Number of anoldes and shields applied depend on the size of the crankshaft.

CALIFORNIA PLANT INSTALLS SELF-OPERATING TEMPERATURE REGULATORS

For its chrome plating tanks, Chrome Crankshaft Company, Inc., needed round-the-clock temperature control, with protection against failure of the control power source. The use of a self-operating temperature regulator requiring no outside power source proved to be the answer.

At the company's plant in Los Angeles, California, a 24-hour operation of plating hard chrome on the journal surfaces of costly diesel crankshafts requires a maintenance-free temperature control system to avoid breakdowns.

According to L. A. Booker, president of the company, some of the diesel crankshafts weight as much as 7000 pounds. Hard chrome application normally varies from 0.0001 to 0.090 inch.

"The temperature of the 33 per cent chromic acid solution must be very closely maintained," Mr. Booker said.

He pointed out that any breakdown in the temperature control power supply would cause damage to the crankshaft being plated.

A self-operating regulator on each of the company's four plating tanks.

The regulator consists of a liquid-filled bulb, capillary tubing, and diaphragm-type valve all in one unit.

The bulb and capillary are plastic coated to resist plating bath corrosion and to prevent contamination of the bath with the bulb metal. The bulb is immersed in the chromic acid in the plating tank, with the capillary tube running from it to the regulator on the hot water line next to the tank.

A temperature change at the bulb varies the pressure of the volatile liquid inside. Pressure is transmitted through the capillary to a bellows which opens or closes the valve in a gradual manner. This regulates the flow of hot water at 190F through a coil in the tank to maintain a constant temperature

*Powers No. 11-MF, manufactured by Powers Regulator Co., Skokie Illinois.

NEW STEVENS WAREHOUSE OPENS IN INDIANAPOLIS

Official opening of a new warehouse and office for Frederic B. Stevens, Inc., was a two-day open house affair on Nov. 5 and 6.

The new location for all Stevens facilities in Indianapolis is at 5345 Lexington Avenue, moved from 4000 East 16th Street.

Because of additional space in the new 15,000 square-foot building, Stevens expects to provide quicker delivery and greater freight savings on its line of equipment and supplies for foundries and metal finishing shops in the Indianapolis area.

Personnel at the new location will remain the same, with Vincent Bruce and Gene Conreaux representing the Stevens foundry department and Roman Bender representing the Stevens metal finishing department.

Stevens, a subsidiary of the Udylite Corp. of Detroit, has offices and plants throughout the country.

MORRIS BAKER

Morris Baker, 75, died on October 31 after a short illness. He was founder and president of M. E. Baker Company, 25 Wheeler Street, Cambridge, Massachusetts

Mr. Baker founded the company bearing his name 30 years ago. He was an active member in good standing of the AES Boston Branch since its inception. He leaves nine children, 33 grandchildren and four great-grandchildren.

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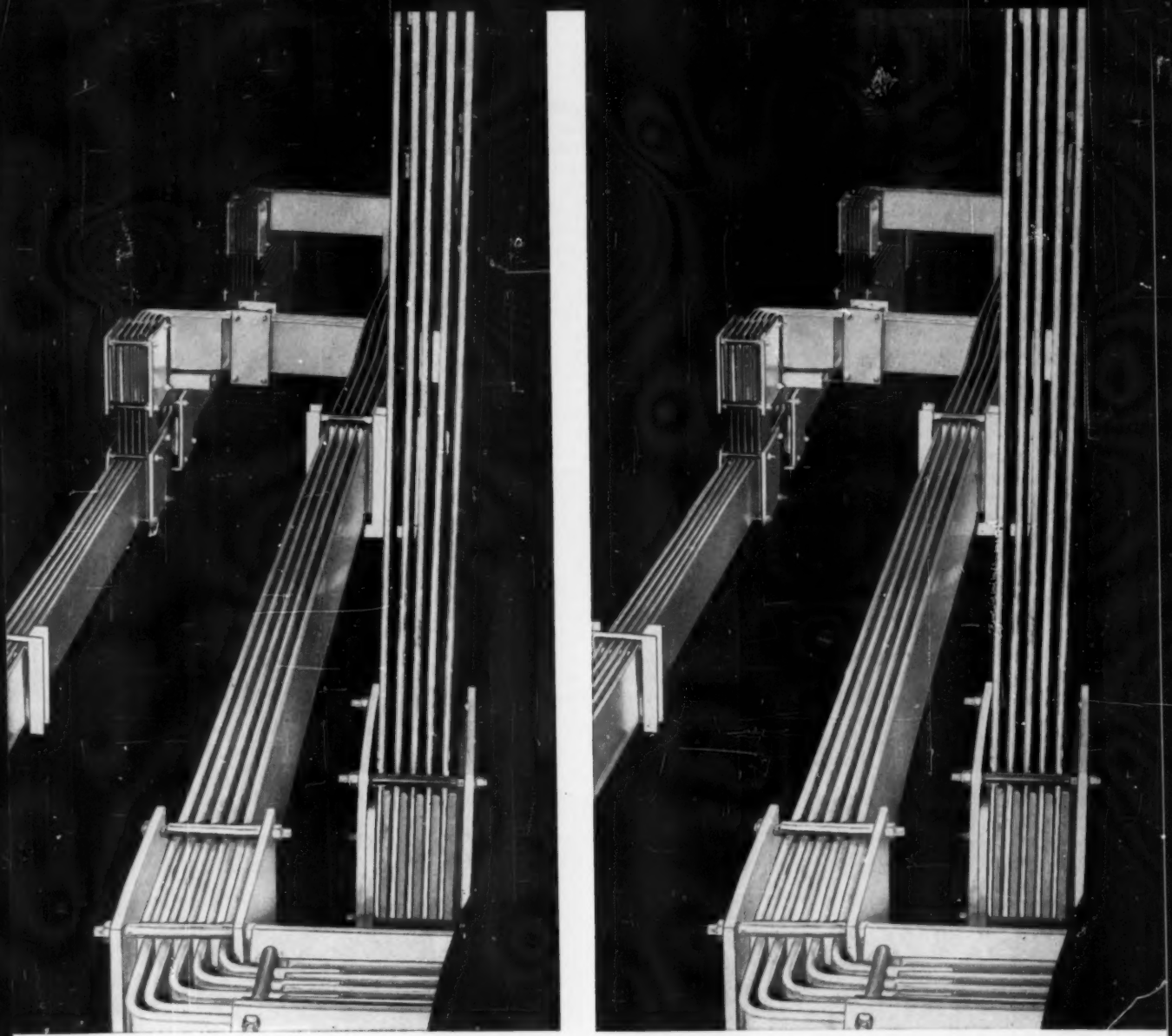

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Write on company letterhead for *Alcoa Aluminum Bus Conductor Handbook*

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UDYLITE RESEARCH INCREASES METAL FINISHING CHEMICALS MANUFACTURING CAPACITY

The Udylite Research Corporation is doubling its capacity for manufacturing chemicals used in metal finishing with installation of five new reactor units at its million-dollar research center in Detroit.

Operation of the new equipment is a novel combination of research and manufacturing facilities designed to provide basic chemicals of highly controlled quality for decorative and corrosion resisting metal finishers.

As a subsidiary of the Udylite Corporation, the Research organization channels the bulk of its specialized manufacture to the adjacent Udylite plant. This plant, in turn, produces chemicals for electroplating processes in the appliance, aircraft, automotive and a wide range of other industries.

The new facilities at Udylite Research include a physical addition of 20,000 sq ft of plant space. The addition brings the total research plant area in northeast Detroit, to more than 50,000 sq ft. Adjacent manufacturing facilities total 185,000 sq ft.

The latest installation at Udylite Research illustrates the fast growth of processing facilities for a group whose principal function is associated with laboratory-scale work. The first 100-gal chemical reactor was turned to manufacturing in 1954, shortly after completion of the research center. The current physical addition permits future installation of fifty per cent more reactor capacity.

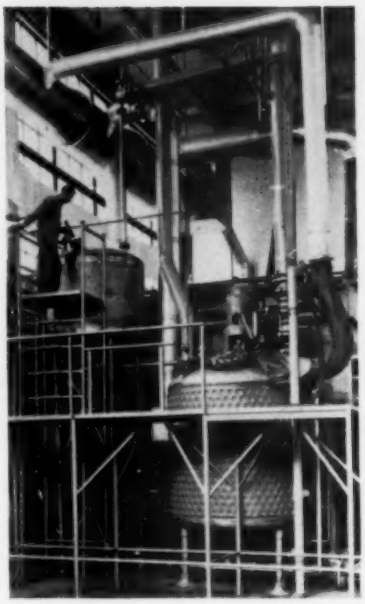
Two major considerations led research people into the manufacturing end of the business in the first place, according to Dr. Henry Brown, director of research.

"Necessity for strict quality control in production of certain important additions to plating formulations is the first," he stated. "Then, the economics of small-batch production makes it impractical for many commercial chemical companies to produce the materials at practical prices."

The new additions to the research-manufacturing facilities now include separate reactor and processing flows for at least a dozen distinct chemical products. Separate reactors, tanks, filters, pipelines, pumps and packaging outlets are provided for each product.

The processing flow has been planned for minimum handling. Product-approved lined tanks, reactors and pipes carry the finished chemicals from storage tanks to a 10,000-lb truck scale at the fill station.

A heated roadway was also completed at the time of the addition to keep the path between the research center and the Udylite manufacturing plant free of snow and ice.



Newly installed autoclave runs chemical reactions at over atmospheric pressure at the expanded Udylite Research Corporation plant in Detroit. Essentially a large pressure cooker, the autoclave holds 1500 gallons of fluid at up to 75 psi. It is housed in a 2100-sq ft reinforced concrete room.

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Technological knowledge acquired through many years of experience, plus special processes and equipment, assure the high quality of our Rhodium Plating Solutions.

Recommended for contact surfaces of switches, waveguide parts and other electrical applications, such as printed circuits...Can be applied in extremely heavy deposits, up to 100 milligrams per square inch.

Rhodium plating provides the advantages of whiteness, lustre and corrosion resistance of a precious metal.

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Interrupts voltage to main line starter of rectifier feeding current to plating tank, where interruption is desired. Capable of handling rectifiers with capacity ranges from 500 to 10,000 amps.

TYPE CIDC

Interrupts current using auxiliary DC switch of proper capacity for interruption at bus-bar. Models available from 250 to 1500 amps DC:

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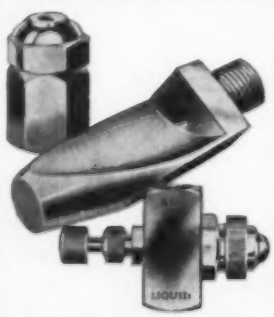

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INDUSTRY NEWS BRIEFS

SAX OF AMEBICAN BUFF BUYS J. J. SIEFEN COMPANY

Purchase of the J. J. Siefen Company of Detroit has been announced by Ben P. Sax, chairman of the board of the American Buff Company, Chicago.

Established in 1927 by J. J. Siefen, the Siefen Company manufactures buffing compounds and spray equipment for the metal finishing industry.

It will retain its separate identity and will continue to operate as a separate enterprise. The company also has offices in Chicago, Cleveland, Los Angeles, Syracuse, New York; Beloit, Wis.; Flint, Mich.; and Hamden, Conn.

Mr. Sax bought the Detroit company from Mrs. Ida Siefen Stark, widow of its founder.

A. J. MacDERMID SELLS CONTROLLING INTEREST IN MacDERMID INC.

Archie J. MacDermid, prominent Waterbury industrialist, recently sold controlling interest in MacDermid Incorporated.

Under terms of the $1,500,000 transaction, representing 31 per cent of the outstanding stock, MacDermid sold 16,240 shares to 55 employes at a price of $33.16 per share. His remaining holdings of 29,000 shares were purchased by the company at the same price. Eighty per cent of the employes now own 72 per cent of the voting stock.

At the meeting at which the transaction was approved, Harold Leever, company president, told stockholders that increased expenditures for research and development resulted in a sales record for the fiscal year to March 31, 1959, despite the recession. For the first four months of this year to July, sales exceeded last year's mark for a comparable period by 58 per cent and were 22 per cent ahead of the fiscal year level. Annual sales are between 5 and 6 million.

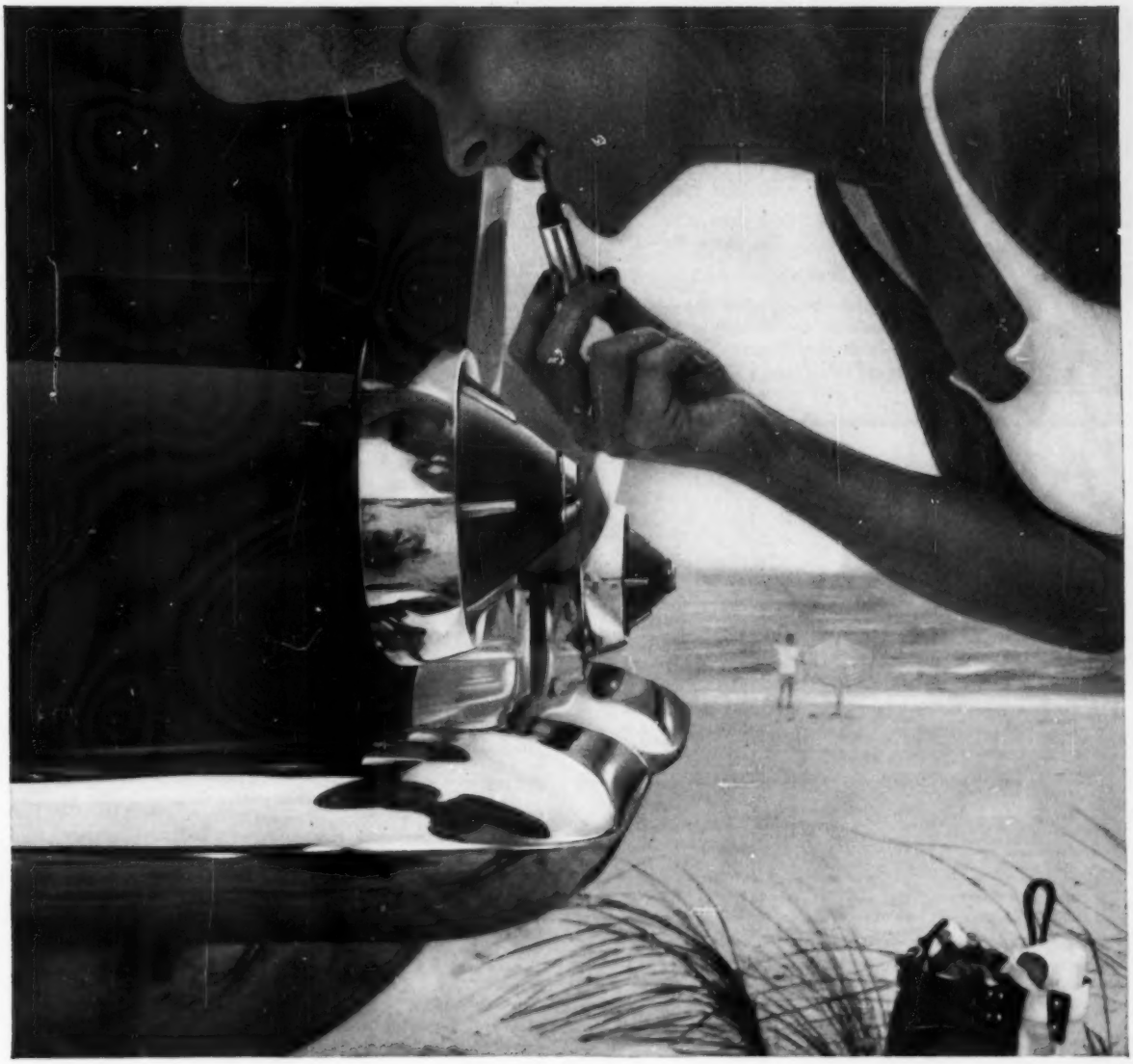
Mr. MacDermid resigned as board chairman and director, and will retire. In addition to Mr. Leever, other officers and directors, who remain the same are: Stanley S. Krentel, Detroit, executive vice president; Thomas A. Downie, vice president and secretary; Arthur R. McNeil, vice president and New England sales manager; J. Douglas Lunan, treasurer; and John A. Hawksley, general superintendent.

Mr. MacDermid established the company in Waterbury, Connecticut, in 1922 doing a local business in metal cleaning compounds. Today plants or distribution headquarters are in Waterbury, Connecticut; Ferndale, Michigan; and Torrance, California. Warehouse stocks and representatives are located in the principal metal finishing centers of the United Sales and abroad.

CARBORUNDUM AND HARBISON-WALKER JOINTLY FORM SUBSIDIARY

Formation of Harbison-Carborundum Corp. by Harbison-Walker Refractories Co., Pittsburgh, Pennsylvania and The Carborundum Co., of Niagara Falls, New York was announced jointly by E. A. Garber, president of Harbison-Walker, and General Clinton F. Robinson, Carborundum's president. Harbison-Walker, world's largest refractories manufacturer, and Carborundum, a principal factor in the abrasives market and in the manufacture of super refractories, will pool their advanced refractories technology and sufficient financial resources to establish a jointly owned subsidiary for the engineering, manufacture and sale of fused refractories.

Owned on a 50-50 basis, Harbison-Carborundum will own and operate Carborundum's recently modernized and expanded plant in Falconer, New York. Additional new facilities are contemplated at a location not yet announced.



Nickel-Chrome Plating Reflects the Quality Appeal of Enduring Beauty

If salt air won't harm the eye-appeal of quality Nickel-Chrome Plating... what will?

De-icing salts? Traffic abrasions? Flying stones and gravel? Freezing temperatures?

All these meet their match in quality Nickel-Chrome Plating... plating with a good, heavy, *duplex* nickel coating underneath.

For this good, *bright*, double-thick nickel coating with a surface layer of chromium not only provides the shining beauty you see and admire ...but it also provides *lasting* beauty, and beauty *easy* to care for. That's because it protects the basis metals from rust and corrosion. It protects new car trim against nicks and scratches.

So with Nickel in ample supply as far into the future as any man can foresee, you can now plan to use *duplex* nickel coatings to get this *double* benefit:

1. to improve the appearance of brightwork . . . to make it more desirable and salable.

2. to improve brightwork durability to help keep your customers happy, satisfied, *and sold.*

For more information about versatile nickel coatings, write us for our informative booklet, "PRACTICAL ANSWERS TO 40 PRACTICAL QUESTIONS ABOUT NICKEL PLATING."

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Copies of patents may be obtained by writing to Commissioner of Patents, Washington, D. C. Price 25 cents each.

Reissue No. 24,596, 1/27/59—Cleaning Aluminum, assigned to The Diversey Corporation, Illinois.

A reissue of U. S. patent No. 2,705,500 (4/5/55) describing a method of cleaning and deoxidizing aluminum, finds claim 8 (of 13) rewritten.

No. 2,884,344—4/28/59—Nickel Plating—E. Ramirez, assignor to Reynolds Metals Co., Richmond, Va.

Claim 1 reads—"A chemical nickel cation hypophosphite anion plating solution containing an aggregate amount of approximately 0.1 to 100 parts per million by weight of the solution of at least two of the metallic elements of Group Va of the periodic system the two metallic elements being present in ratios ranging from about 1:5 to 1:0.5."

13 claims.

No. 2,884,350, 4/28/59—Solderable Zinc Coating—E. Saubestre, assignor to Sylvania Electric Products, Inc., Mass.

A process for treating zinc (75–95 per cent)—Tin (25–5 per cent) coatings involving treating with an oxidizing solution to convert the matte, white surface to a thin oxidized film.

The object is to make surface passive to finger staining.

6 claims.

No. 2,884,364, 4/28/59—Plating on Uranium—E. Reboe and R. Wehrmann, assignor to USA (AEC).

Pickle the uranium metal with trichloracetic acid, treat with nitric acid and plate.

7 claims

No. 2,885,055, 5/5/59—Processing Machine—P. Hauck, assignor to Hanson-Van Winkle-Munning Company, Matawan, N. J.

A machine with *n* components to be operated in sequences with a pair of shafts one rotating at 1-1/n revolutions while the second makes one revolution for control.

6 claims, figure.

No. 2,885,273, 5/5/59—Etching Metals—P. Degoetz and Le Roy P. Streett, assignors to North American Aviation, Inc.,

A method of etching aluminum involving forming a mixed metallic oxide surface coating, stopping off with an acid resist and then treating with an acid solution of dichromate, phosphate and fluoride ions, followed by hydrochloric acid etching.

5 claims.

No. 2,885,301, 5/5/59—Chromizing Coating—G. Samuel, assignor to Metal Diffusions, Inc., Philadelphia, Pa.

A method is described wherein iron and steel parts are coated with a powdered glass composition, a source of chromium, a chromium halide and a bodying material, then subjected to a temperature of 1600–2300 F.

12 claims.

No. 2,855,304, 5/5/59—Aluminum Coating—R. Thompson, *et al* assignors to General Motors Corp., Detroit, Mich.

Claim 13 reads: "A method of forming a corrosion-resistant valve for an internal combustion engine which comprises cleaning a ferrous base poppet valve, preheating the seating face of said valve by induction heating, rigidly rotating said valve, spraying said seating face with molten aluminum particles while said valve is rotating to provide a thin layer of aluminum on said face, subsequently immersing the head of said valve in a fused salt bath consisting essentially of 37 to 57 per cent by weight of KCL, 25 to 45 per cent by weight of NaCl, 1 to 20 per cent by weight of Na_3AlF_6, and 0.5 to 12 per cent by weight of AlF_3, maintained at a temperature of about 1325 to 1375 F and activated by aluminum in contact therewith to cause said aluminum to melt and said face to be fluxed, thereafter rapidly vibrating the valve while the head thereof is immersed in said salt bath to thereby distribute the molten aluminum evenly over said seating face and to remove any excess molten aluminum therefrom, subsequently removing the coated poppet valve from said fused salt bath and permitting the molten aluminum to solidify on said seating face."

13 claims, 3 figures.

No. 2,885,312, 5/5/59—Metal Coating Compositions—Louis McDonald, assignor to Kelite Corp., Los Angeles, Calif.

Claim 1 reads: "A corrosion protective composition for metals comprising an aqueous coating bath including a major proportion of a water-soluble inorganic component reactive with said metal to provide a corrosion-resistant coating thereon and a minor proportion of from about 10–20 per cent by weight based on said water-soluble inorganic component of a polymeric material containing a strong polar grouping selected from the group consisting of polystyrene sulfonic acid, polystyrene phosphoric acid, styrene heteropolymer of maleic acid, styrene heteropolymer of ammonium maleate and polystyrene sulfonic acid ammonium salt."

8 claims.

No. 2,885,313, 5/5/59—Treating Magnesium—Bearing Aluminum—S. Milliken, assignor to Aluminum Company of America, Pittsburgh, Pa.

A treatment for aluminum alloys containing 0.1 to 15 per cent magnesium is described as including the steps 1) coat with an organic ammonium fluoborate (gives BF_3 when heated) and 2) heating said coated article between 400 to 750F to cause disappearance of the organic substance.

See also No. 2,885,315 describing a treatment of aluminum base alloys containing up to 15 per cent magnesium by exposing to an atmosphere containing at least 75 mg of boron trifluoride per cubic foot of furnace in 8 claims.

Also No. 2,885, 316 which describes a vaporous fluoride treatment for wrought aluminum containing gas and voids in 10 claims.

No. 2,885,329, 5/5/59—Nickel Plating—Wolfram Carbide—H. Slatin, assignor to USA (AEC).

Claim 1 reads: "The method of electro-nickel plating articles comprising wolfram carbide which comprises making the article anodic at a current density from 1 to 5 amp/sq in. in an aqueous solution containing from 100 to 250 g/l of sodium pyrophosphate for a time of from 10 to 30 min within a temperature range of from 20 to 60 C and then electrolytically depositing a nickel coating on the resultant etched surface from an aqueous nickel salt solution."

2 claims.

INDICATE A 1239. ➤

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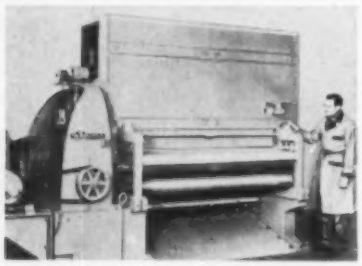
EQUIPMENT AND SUPPLIES

E—1201. Epoxy Repair Kits—The Carboline Co. has released a new epoxy multi-use repair kit for making "on the spot" repairs.

The Carbo Fix repair kit is a two-component, fast setting, epoxy material that cures to a hard, tough, tightly bonded patch, restoring the damaged or broken piece to its original condition. Each kit contains a jar of resin and a jar of catalyst, fiberglas cloth, measuring spoons, stirring paddle and instruction booklet.

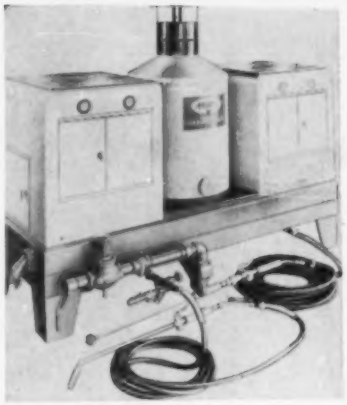
E—1202. Metal Primer—Krylon Rust Magic metal primer, a new spray or brush type primer that dries in 20 minutes, and compatible with almost any finish coat, is the latest product to be released by Krylon, Inc.

It contains a phenolic resin penetrant which, it is claimed, carries the pigment and vehicle through sound rust and locks itself tight to the substrate. This complete penetration seals the surface, locks out moisture and prevents further rust development. The saturating action neutralizes porous rust and makes it an actual ingredient of the paint film.



E—1203. Sheet Polishing Mills—New sheet polishing mills that provide a continuous automated method for performing abrasive belt-finishing operations on metal sheets and plate from 3-ft long and up as well as coils at feeds from 20 to 60-fpm is announced by Acme Manufacturing Co.

According to the manufacturer, these precision machines can be utilized by the automotive industry for prepolishing of carbon steel sheets for plating applications and by the steel industry for sheet polishing as well as the conditioning of stainless steel coil stock. Job shop finishers can use them to polish sheet and plate to standard finishes. The sizing of material to a variety of thicknesses for experimental engineering and pilot line development can also be carried out by the aircraft industry on this type of precision equipment it is reported.



E—1204. Steam Cleaner—A new steam cleaning machine has recently been introduced by Kelite Corp. for cleaning and phosphatizing of large structures and equipment.

Called the Mark IV, it is available in two models—the direct-fired model, fueled with natural, manufactured, or LP gas and the fireless model which draws live steam from a plant's existing steam supply.

The direct-fired model consists of a round heat exchanger, which is eliminated in the fireless model, flanked by a rectangular unit on each side. The unit at the left has two solution tanks, one for an alkaline steam cleaning composition, and the other for a neutral cleaner. The neutral cleaner is used while steam phosphatizing to achieve simultaneous cleaning and phosphatizing. The unit at the right has the acid phosphate solution tank.

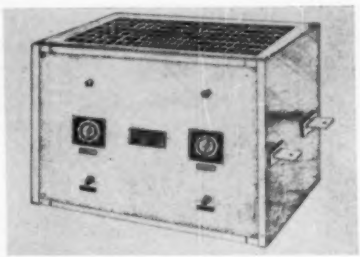
Each unit is equipped with a 300 GPH corrosion-resistant positive-displacement piston-type pump capable of delivering its full rated output hundreds of feet from the machine.

E—1205. Aluminum Cleaning Compound—The Frederick Gumm Chemical Co. announces the availability of a new compound formulated for use in aluminum finishing. The compound, designated Clepo 192-D, is a tumble finishing material which removes oil, dirt and aluminum dust and grindings from aluminum nails, stampings, eyelets and screw machine parts in a single operation. It is said to produce a silvery, lustrous surface with sufficient lubricity to enable parts to slide freely during subsequent automatic feeding operations.

E—1206. Cold Dilutable Stripper—A cold, chlorinated liquid stripper for epoxy enamels which can be diluted with up to 20 parts by volume of water has been developed by Enthone, Inc., subsidiary of American Smelting and Refining Co. Described by Enthone as a major breakthrough in the stripping of baked synthetic enamels, the new dilutable product, called Stripper S-26, performs all of the functions of cold chlorinated strippers which must be used full strength.

Stripper S-26 is acidic in nature and non-flammable. It is used at concentrations of 1 part stripper to from 4 to 20 parts of water by volume. It is operated at room temperature and acts by wrinkling and detaching the enamel from the basis metal. New, hard-to-strip epoxy coatings are removed from most metals including steel, aluminum, copper, brass and zinc die castings. The product is also said to be effective for stripping of plastisol coatings from racks.

The stripping solution is readily maintained by periodic additions of Stripper S-26. Since the stripping solution wrinkles the coating instead of dissolving it, it does not become contaminated with dissolved enamel and has long life.



E—1207. Rectifiers—New Djeco periodic-reverse polarity timing rectifiers are for use when uniform deposits are required in plating. The operation of these rectifiers are cyclic. During depositing cycle of several seconds, a layer of metal is deposited over cathodic work; then the current is automatically reversed. During reversing-deplating cycle, which is a few times shorter than depositing cycle, a part of deposited layer is removed. During each deplating interval the metal is removed most rapidly from regions which are much higher than surroundings.

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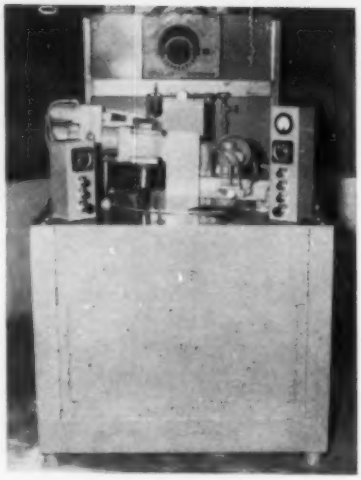
E—1208. Deburring and Finishing Machine—The Mecha-Finish Corp. announce another new Mechamatic unit, the MM-2 High Speed Model No. 3000, 2 spindle unit, which has been designed for low production of a multiplicity of parts and/or high production of a single component. It has two independently operated spindle heads which allows the machine operator to service one spindle while the opposite spindle is in process. The unit can also be supplied with spindle stations interlocked for the purpose of pacing the machine operator.

The parts are mounted on spindle fixtures, air-operated, which are submerged while rotating, in a fluid abrasive mass which simulates a form fitting grinding wheel. The process is completely automatic and controlled except for loading and unloading the parts, for which no special skill is required.



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E—1209. Temperature Program Control—A new recording pneumatic temperature program control, designated Model RCA, was introduced by the Partlow Corp. In addition to its control features, the model is also a temperature recording instrument. It is particularly well adapted in locations where steam is used as a heating medium according to the manufacturer.

The new control was designed to fill a need for a simple and rugged method for program controlling heating appliances that would, at the same time, give accurate and sensitive proportioning valve operation, plus recording. It is available in any of ten optional temperature ranges between the extremes of —30 and 1100F.

E—1210. Acrylic Stripper—Patclin Chemical Co. Inc. has developed a new acrylic stripper, Patclin No. 217 for stripping the difficult baked acrylic resin coatings.

It can also be used to strip wrinkles, hammertones, epoxy, melamines, urea, phenol and alkyd resins. This stripper lifts the coatings and breaks the bond existing between the base metal and the coating. It is said to be especially affective on primed coatings on a phosphated base.

This product is used cold as is, in a ceramic crock or stainless steel tank and is non inflammable.

E—1211. Abrasive Discs and Belts—A new line of resin-bonded aluminum oxide coated abrasives said to possess a sharpness and cutting life never before attained has been developed in the laboratories of Behr-Manning Co., a division of Norton Company. Marketed as Metalite Type 101, the new abrasive is available on fiber discs and cloth belts, both characterized by a uniform and attractive brown color. Throughout, the Type 101 abrasive is said to exhibit extreme sharpness which is sustained even in rigorous service. Type 101 fiber discs are made in a grit range from 150 through 24; belts from 180 through 24.

E—1212. Spray Cleaner—An extremely low-foaming single or multiple stage spray cleaner for general use is now being produced and marketed by Northwest Chemical Co.

Called Jet 108, this new spray cleaner is designed for use on all ferrous and nonferrous metals except aluminum at 100 to 140F operating temperatures. It is claimed to remove drawing compounds, oils, and greases; inhibit rust; and is used following soak cleaners. The higher the concentration of this new spray cleaner, the less it foams. A heavy dirt load is carried without redeposition.

E—1213. Portable Hydroion Meter—A hydroion meter designed for measuring the specific conductance of a solution in locations where electric power is not available is now being marketed by Carma Manufacturing Co.

Easy to handle and read, this portable conductivity tester is said to be particularly suited for testing liquids in plating firms.

The Carma 72734 meter is battery operated and reads ppm in saline or other solutions. It has a temperature compensating adjustment and selector to read either directly or ppm x 10.

E—1214. Chemical Processes—Hanson-Van Winkle-Munning Co. has announced the availability of three new chemical processes: Alcond DX-100; Chem-Rite A-22; and Zincalume.

The new Alcond DX-100 is for desmutting aluminum that has been etched in a caustic etchant and deoxidizing, to remove surface oxides from aluminum prior to anodizing or conversion coating.

Alcond DX-100 can be operated over wide ranges. Operations employing this product should be performed in tanks lined with polyvinyl coatings or made of stainless steel.

The new aluminum conversion coating process, Chem-Rite A-22, is an easy-to-use, inexpensive chromate surface conversion coating treatment. For ease of handling it is supplied as a liquid concentrate.

Chem-Rite A-22 solves two problems, H-VW-M claims. It eliminates messy, hard-to-dissolve powdered materials as well as chemicals wasted by incomplete dissolution.

Brush Chem-Rite A-22 is used for parts too large for available dip equipment or for processing parts in quantities so small as not to justify the cost of installing tanks.

Zincalume process is said to produce brilliant deposits in both still and barrel equipment.

Bright deposits are produced at either high or low current densities with slight changes in composition or operating conditions. Maintenance of the bath is simple. The bright Zincalume deposit can be bright dipped in nitric acid as well as chromate conversion bright dips.

E—1215. Synthetic Detergent—Conversion Chemical Corp. has announced the new Kenvert Sluff-Off X, a synthetic detergent for removing buffing compounds by soak or ultrasonic cleaning from all metals without attack.

This new product is water soluble and removes buffing compounds which may be high in tallow, or where there are oily conditions from a wide variety of metals including steel, copper, brass, aluminum, nickel, silver and zinc die castings. It is said to be particularly effective on stubborn compounds which have impacted overnight and weekends. Also, it readily removes compounds from aluminum and zinc which have combined chemically to form metallic soaps. Ferrous parts treated in this detergent are reported to have a tendency to resist rusting, which is advantageous in many applications.

E—1216. Paint Strippers—Heatbath Corp. announces its entrance into paint stripper products by introducing two new products, Durastrip A-1 and Durastrip No. 2.

Durastrip A-1 is an alkaline-type powder that has been designed for stripping lacquers, enamels and phenolic coatings. A concentration of 1½–3 lb/gal of water is recommended with the solution being operated at the boiling point.

Durastrip No. 2 is a two-phase, solvent-type paint stripper that removes paint films by wrinkling rather than dissolving them. This material is used as received at room temperature to quickly remove highly resistant paint finishes such as epoxy resins, acrylics, vinyls and polyesters. Durastrip No. 2 can be used to remove paint finishes from steel, aluminum, copper, cad and zinc. Stripping is accomplished in the lower solvent phase of Durastrip No. 2 solutions.

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TRADE LITERATURE

L—1201. Time Calculator—The plating time required to obtain desired thickness of plate at any current density may be readily determined by using the Enthone Plating Time Calculator. Simply set the plating thickness desired opposite the metal to be plated and read the plating time required opposite the current density to be used. The times necessary for plating nickel, chromium, cyanide copper, acid copper, cadmium, zinc, silver and stannate tin can be read directly.

On the reverse side of the slide calculator is the Enstrip Selector which tells the proper Enthone Enstrip metal stripper to use to strip a wide variety of plates from a number of different basis metals. Methods for stripping nickel, copper, brass, chromium, cadmium, zinc, tin, soft solder, silver and gold from basis metals such as steel, copper, brass, zinc die castings, aluminum and magnesium are included.

L—1202. Anodizing Bath Additive—Technical Processes Division of Colonial Alloys Co. has issued Bulletin No. 62559-6 which tell that by adding a tiny amount of additive to any sulfuric acid anodizing bath, noxious vapors are smothered and virtually eliminated. At the same time an action takes place on the anodized work and racks, which it is claimed makes them more easily rinsable and therefore cleaner, in less time than was heretofore possible.

L—1203. Peening Machine—Bulletin PPD-109 describes the new Model A-50 Perfecto-Peen machine for peening, cleaning and finishing by a patented process using specially-treated minute glass beads. Machine specifications are listed together with installation requirements and a cutaway view showing arrangement of components.

L—1204. Temperature Controls—"Precision Temperature Controls in Industrial Plants" is the title of a new 8-page folder issued by Fenwal Inc. Line drawings portray how controls are used in gas exhaustion chambers, tempering tanks, pipe-lines, test ovens, plating tanks, electrostatic sprayers—and air temperature and radiant heat applications. Also included are brief descriptions of controls suitable for these purposes.

L—1205. Acidic Brighteners—An acidic solution for producing bright lustre on non-silicon aluminum alloys is described in technical data sheet no. 55, a two-page usage and instruction sheet prepared by MacDermid Inc. With this product, called Metex Electropolish BA, the surface finish of the metal is claimed to be improved and brightened and burrs are removed without mechanical or manual operation.

An acidic solution used to produce a bright lustre on lead-free wrought brass is described in technical data sheet no. 41. Called Metex Electropolish BB, the solution is used full strength as received at a temperature of 125F. Control by specific gravity and analysis of trivalent chromium reportedly enables the solution to be used for long periods before dumping.

L—1206. Vibrator—Bulletin No. 1016E describes Lord Chemical Corp.'s new 3-hp Model 1016E vibrator for precision finishing of metal, plastic or wooden parts. The four-page bulletin gives general information, construction features and detailed specifications, including standard equipment. The new vibrator has a bowl capacity of 1.1 cu ft.

L—1207. Metal Cleaning—"Some *More* Good Things to Know About Metal Cleaning", just published by Oakite Products, Inc., contains 28 pages of information on metal cleaning and treating.

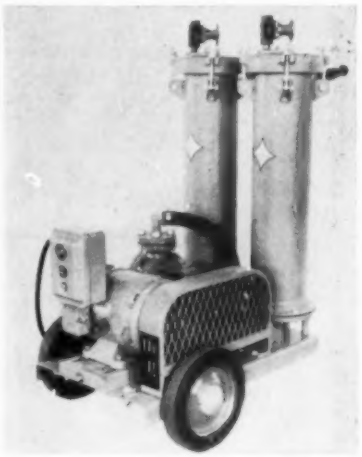
The booklet discusses the chemistry and techniques of cleaning; tank cleaning, with suggestions for tank design and layout and selection of detergents; electrocleaning; barrel cleaning; machine cleaning; and ultrasonic cleaning.

It also describes pickling, deoxidizing, and metal etching treatments; prevention of rust between operations and in storage; paint stripping; and paint spray booth water curtain additives.

L—1208. Liquid Treatment Units—A new bulletin on Reta-Rake clarifiers and thickeners, water and liquid treatment units, is available from Graver Water Conditioning Co. It should be of interest to all users of horizontal flow gravity separation equipment.

The new bulletin, WC-123, contains drawings and data on the main model types. These include bridge-supported and center-post designs from 10-ft diameter or square to over 150 ft.

Included is a description of operation and a discussion of design features such as the submerged orifice plate water collection system and the heavy-duty box-truss scrapers.



L—1209. Portable Filters—Two recently introduced plating filters feature compactness and mobility. They are designed to eliminate piping and valves between tanks and the need for separate filter stations, and are described in Industrial Filter and Pump Mfg. Co.'s Bulletin 118.

Designated as the improved type 118, one provides 600 gph flow capacity and up to 15 square feet of filtration area. The other is rated at 1200 gph and has 600 square feet of filtration area. Six-inch diameter rubber-tired wheels and full-swivel rear coaster enhance mobility and speed at which new filters can be put to use.

Furnished as a complete filter "package", type 118 filters come equipped with the following: rubber lined centrifugal pump; 10 feet of suction hose; 15 feet of discharge hose; a combination ball check foot valve and strainer; motor and starter with thermal overload.

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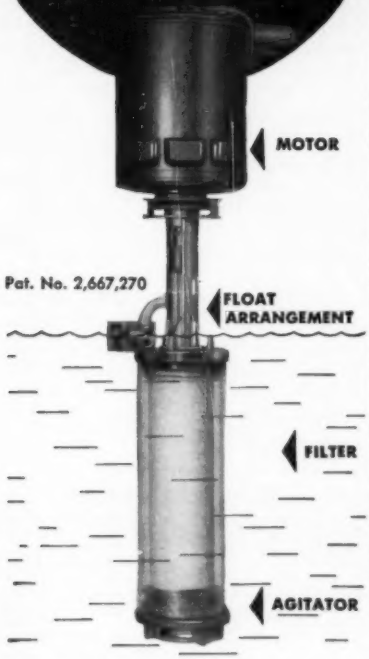

- ✔ Keeps Surface Clean Constantly Regardless of Solution Level
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- ✔ Entire Unit Submerged in Tank, Cannot Aerate Solution
- ✔ Requires Small Space in Tank . . . No Equipment in Aisles
- ✔ Large Filter Area at Low Cost . . . Easy to Clean
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Exclusive National Sales Representative — THE CHEMICAL CORPORATION — makers of LUSTER-ON chromate conversion coatings for zinc, cadmium, copper, brass, aluminum.

Write for further information and name of your nearest distributor.

The Chemical Corporation

57 Waltham Ave. • Springfield 9, Mass.

L—1210. Abrasive Wheels—Over 1600 experience-tested abrasive wheel recommendations for grinding everything from Agate to Zirconium are set up in alphabetical order in The Carborundum Co.'s new 57-page, three-hole punched specifications catalog. Material, work, operation—with their respective recommendations on abrasive, grit, grade and bond—are listed.

L—1211. Paint Strippers—A new four-page brochure describing their complete line of paint strippers has been published by Enthone, Inc. subsidiary of American Smelting and Refining Company. Entitled "Let the Enthonics Laboratory Custom-Solve Your Paint Stripping Problems", the brochure also describes the service which the company offers of formulating new paint strippers to meet the specific requirements of individual customers.

Strippers of air dry and baked synthetic enamels as well as printed circuit resists are featured in the booklet. Types such as fast-evaporating, cold chlorinated, organic emulsion, hot alkaline and the newly developed water-dilutable cold strippers are discussed. Methods of removing epoxies, vinyls, alkyds, phenolics and other synthetics are explained.

L—1212. PVC Tank Lining—A 6-page illustrated brochure describes Amer-Plate industrial lining, a polyvinyl chloride sheet for lining plating, pickling and other tanks and vessels. It protects steel and concrete tanks from attack by strong solutions, and as a result is said to prevent contamination of the solutions. It may be used as a simple lining material or as a membrane under acid-proof brick construction.

Two styles available are described. For existing concrete and steel surfaces, plain lining is applied with a special adhesive. If new concrete is to be poured, T-Lock sheets are used.

L—1213. Metal Cleaner—A new metal cleaning handbook presenting over one hundred types of equipment and techniques for the cleaning and preparation of metal surfaces, has been released by the Equipment Division of Magnus Chemical Co.

The 32-page handbook covers both the basic factors in metal cleaning and specific methods to meet a variety of cleaning problems, including degreasing, decarbonizing, washing, bonderizing, stripping, drying, blackening, phosphatizing, rust proofing, pickling, and coating. Various sections cover the analyzing of cleaning problems and the subsequent selection of the correct chemical method and equipment for the individual job.

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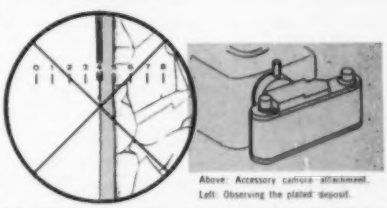
MEASURE PLATING THICKNESS

to a millionth of an inch

Your profits depend on meeting tight specifications, maintaining quality control and reducing rejects. Can you afford to guess at plating thickness when it is so easy to *measure and be sure*?

UNITRON'S PL-MEC PLATER'S MICROSCOPE **substitutes facts for uncertainty. The plated deposit is observed through a Filar Micrometer Eyepiece and measurements are read directly from a micrometer drum. This compact microscope is easy to use, portable around the shop and has a built-in light source. It also doubles as a metallurgical microscope for examining grain structure etc. at magnifications of 25X-1500X. Permanent photographic records may be made using an accessory 35mm. camera attachment and provide valuable legal protection for subcontractors.**

UNITRON'S PLATER'S MICROSCOPE **will save its initial cost many times over. Prove this for yourself — as so many firms in the plating industry have done—by requesting a FREE 10 DAY TRIAL in your own plant. There is no cost and no obligation.**



Above: Accessory camera attachment.
Left: Observing the plated deposit.

$468 Model PL-MEC complete with all optics and standard accessories	As above with built-in camera attachment, but without 35mm. camera back: **$540**

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PERSONALS

W. DOUGLAS CUNNINGHAM has been appointed district sales manager for Kelite Corp. Mr. Cunningham will be responsible for Kelite sales in the Dallas, Texas District of the Western Sales Region. His headquarters will be at Kelite's Dallas facility.

He has been a Kelite sales engineer for the past 8 years.

•

CHARLES N. CHALFANT has been promoted to senior product manager—metal finishing by Kelite Corp.

For the past year, Mr. Chalfant has been product manager—metal finishing for the firm. In that position, he has been responsible for the development of metal finishing sales in Eastern and Midwestern sales regions.

In his new position, Mr. Chalfant will continue his field responsibilities. In addition, he will have a new staff function in providing training.

Mr. Chalfant has been active in laboratory and sales work in the metal finishing industry for more than 30 years. He majored in chemistry at Carnegie Tech, and is a member of the AES. He will continue to make his headquarters at Kelite's Berkeley Heights, N. J. plant.

W. D. Cunningham

C. N. Chalfant

•

DR. JOHN C. McGREGOR, president of The Narda Ultrasonic Corp., has assumed full operating as well as policy direction of the company. Paul M. Platzman, executive vice president, is no longer with the firm.

RICHARD E. ELDEN has been promoted to resident manager and **RICHARD F. BRAUN** has been appointed to succeed him as production manager at the Vancouver, Washington, plant of the Becco Chemical Division, Food Machinery and Chemical Corp.

Mr. Elden, a graduate of Massachusetts Institute of Technology, joined Becco in 1946 as a research chemist in the laboratory in Buffalo. In 1951 he was promoted to chief chemist of the Vancouver plant, and in 1956 he was named production manager.

Mr. Braun has been with Becco in Vancouver since 1957, when he joined the company as production superintendent. He is a graduate of Stanford University.

•

VICTOR M. SCHWARTZ of Los Angeles, has been made a director of The Udylite Corp. Mr. Schwartz is executive vice-president and general manager of the L. H. Butcher Co., the Udylite subsidiary. He replaces on the Udylite board his uncle, W. D. Schwartz, who recently retired.

Used by Platers, Silversmiths, Jewelry Manufacturers, Makers of Watches, Clocks and Electronics and other metal finishers.

Supplied in straight or crimped brass, steel or nickel silver wire in sizes .0025 to .006
Also available in Stainless Steel, Bristle, Fibre or Nylon
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TAMART . . . Developed especially for Buffing Compounds. A composite abrasive or siliceous material recommended for bar and liquid compounds, also for cast brass, drawn brass, stampings, zinc die-castings, copper, aluminum, etc.

Free of impurities. Improves the emulsion stability of liquid compounds because of its extremely low alkali content. (such as Ca Na K Mg).

RED SEAL SILICA . . . 92% to 94% thru 325 mesh screen. Ground from White Crude. Low pH and controlled Oil Absorption.

TAMART and RED SEAL SILICA are both produced at our Tamms, Illinois plant. They are low in cost and readily available in straight or combined shipments.

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for NICKEL PLATING

The one bath especially designed for plating DIRECTLY on ZINC, LEAD, ALUMINUM, BRASS, COPPER and IRON. TREMENDOUS THROWING POWER.

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Harder CRACK FREE deposits. Increased throwing power. Less sensitivity to sulfate content. Exceptionally fine results plating anything calling for Decorative or Hard Chrome.

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USE READER SERVICE CARD; INDICATE A 1248.

What's new in Metal Treatments and Etching?

Quite a few things. For example, there's the use of Becco Ammonium Persulfate in etching printed circuits. Seems the material works a lot better – at less cost – and with none of the hazards of the ferric chloride solutions conventionally used.

Then, there's the problem of pickling copper and brass. Lots of pickling agents will do this – only trouble is, you've got to paint or plate or do whatever you're going to do with the metal rather quickly. Or else. Or else it will tarnish or oxidize and you're in the pickle all over again.

Not so with Ammonium Persulfate. Cleans fine. Puts a mild etch on the surface, too, for better paint or plating bonding. More important, perhaps, is the fact that the metal resists retarnishing for up to two weeks. Ideas?

We hope so. What's more, we've got several booklets to help spur you on. They're free—use the coupon below to order.

No. 39 and 51—Surface Treatment of Metals with Peroxygen Compounds.

No. 86 – Improving Properties of Copper and Brass Surfaces.

No. 97 – Paddle Etching of Printed Circuits with Ammonium Persulfate.

No. 99 – Tank Immersion Etching of Printed Circuits with Ammonium Persulfate.

No. 102—Etching of Printed Circuits with Mercury Activated Persulfate.

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John Lockerbie

JOHN LOCKERBIE HONORED BY ST. JOSEPH VALLEY BRANCH

John Lockerbie, an AES Honorary Member and active in plating for over a half-century, was honored on his 78th birthday at a dinner by the St. Joseph Valley Branch held in South Bend, October 7. National President Ralph D. Wysong extended him the AES's hearty congratulations.

The new director has served with the Butcher Co. since he was 20 years old. Now 46 years of age, he was elected treasurer of Butcher in 1944, vice president in 1952 and has held his present position for the past six years.

V. M. Schwartz

T. A. Rohlfsen

T. A. TED ROHLFSEN, of Sherman Oaks, has been appointed manager of the South Pacific Coast Division of Oakite Products, Inc. Mr. Rohlfsen succeeds **J. C. LEONARD,** who is retiring after 35 years of service with the company.

Educated at Los Angeles City College and Santa Barbara State College, Mr. Rohlfsen joined Oakite in 1947 as technical service representative in Los Angeles. His outstanding performance in that post was recognized in 1955 when he received a citation for distinguished Oakite service.

In his new position, Mr. Rohlfsen will direct the activities of 14 technical service representatives in Southern California.

●

EUGENE O. EAGLE of Greensboro, North Carolina, is now representing Northwest Chemical Co. in the states of Virginia, North Carolina and South Carolina.

Mr. Eagle, a native of North Carolina, will operate from his home office at 302 S. Tremont Drive, Greensboro, North Carolina.

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1—7500/3750 AMPERE, 9/18 VOLT, **H-VW-M,** Synch.

1—7500/3750 AMPERE, 6/12 VOLT 25°C. **CHANDEYSSON,** Synch.

1—6000/3000 AMPERE, 6/12 VOLT, **ELECTRIC PRODUCTS,** Synch.

1—5000/2500 AMPERE, 12/24 VOLT, **CHANDEYSSON,** Synch.

2—5000/2500 AMP., 9/18 V., 25°C., **CHANDEYSSON,** Synch. Exciter-in-head.

1—5000/2500 AMPERE, 6/12 VOLT, 25°C. **CHANDEYSSON,** Synch.

1—4000/2000 AMPERE, 6/12 VOLT, **H-VW-M,** Synch., Exc.-in-head.

3—3000/1500 AMPERE, 12/24 VOLT, **CHANDEYSSON,** Exciter-in-head.

1—2000/1000 AMPERE, 6/12 VOLT, **H-VW-M.**

ANODIZERS

1—1000 AMPERE, 40 VOLT, **CHANDEYSSON,** 25°C.

1—1000 AMPERE, 30 VOLT, **IDEAL,** Exciter-in-head.

1—500 AMPERE, 25 VOLT, **CHANDEYSSON,** Synchronous, Exciter-in-head.

2—400 AMPERE, 40 VOLT **M.G.C.,** Separately Excited.

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1—**SEL-REX** SELENIUM, 1200 AMPS., 9 V. for 440/3/60.

1—1500/750 AMPERE, 6/12 VOLT, **UDY-LITE-MALLORY.**

1—**NEW G. E.** 2000/1000 AMPS., 6/12 V. Remote Control 440/3/60 AC.

SPECIAL

2—**CROWN & H-VW-M** Centrifugal Driers No. 1 and No. 2 with Heat.

2—**MERCIL** Ball Burnishing Barrels, Sizes 1 and 2.

3—**LASALCO** Ball Burnishers, No. 1, 2 & 4, Lined or Unlined.

1—**L'HOMMEDIEU** 5 H.P. Variable Speed Buffer, Model 18.

10—Buffing Lathes—**HAMMOND, DIVINE, U. S.,** etc., from 3 H.P. to 20 H.P.

2—**INDUSTRIAL** RDR-1 Rubber Lined Filters, Sizes 10x28, 14 x 36.

2—**INDUSTRIAL** Type SC Filters for Cyanide. 18x48 and 18x36.

4—**STEVEN BADER** Abrasive Belt Polishers.

3—**AMERICAN** Blower type HS fans, Size 330-10.

15—**DUSKOP** Dust Collector Cabinets. Sizes No. 550, No. 850, No. 1100.

1—**H-VW-MUNNING** Type (Mechanical lift), Hull Automatic, Plating Machine 70' long x 4' wide x 36" deep x 10½' overall height.

Other outstanding values in stock.
1929—1959 — 30 Years of Service.

M. E. BAKER CO.
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BRANCH NEWS

Total AES Branches U. S., Canada, Australia, December 1, 1959—58.

BRIDGEPORT

Foley Talks on Sulfamate Nickel; Branch is Regional Host

The regularly scheduled business meeting and educational session was held in the main ballroom of the Hotel Barnum on Friday, Oct. 9. The meeting was called to order by First Vice President **W. Hyatt Jr.** Two applications for membership were received and one new member accepted and presented with a membership certificate and pin.

Al Ferguson reported that at the recently held committee meeting of the Twenty-first New England Regional in Hartford, Bridgeport assumed its Host Branch duties and plans are going forward for the meeting to be held in the Hotel Statler, Hartford on April 23, 1960. The Branches were given their respective assignments: Hartford, advertising; New Haven, education; Springfield, entertainment and Waterbury, publicity. **Bob Parker** was appointed secretary and treasurer. The possibility of advancing the date of the Regional for 1961 to coincide with the Interim Meeting was decided as being impractical because of our commitments, however, it was agreed that we would spare no effort in aiding the National Society in their interim activities.

Edmond Owen stated the Christmas dinner-dance would be held on Saturday, December 12.

A surprised chairman, **Charles Temple,** finally accepted his charge and a committee is to be formed shortly to expedite the details of Olde Timers Nite. The Branch members will visit the Pitney Bowes plant next spring. Librarian **Al Jocis** introduced the featured speaker for the evening, **Edward Foley** of Barrett Chemical Co. Mr. Foley discussed the advantages of Sulfamate Nickel Plating in barrels as well as still tanks. He stressed the simplicity of operation of the bath and passed out many samples of plated parts.

Robert A. Parker
Secretary-Treasurer

BUFFALO

Doughty Discusses Cyanide Copper Plating

The October meeting of the Buffalo Branch was held Friday, Oct. 2, at the Peacock Inn in Mayville, N. Y., with 38 members and eight guests in attendance.

Dick Davis, our Librarian, introduced **S. Lewis Doughty** of the Lea Manufacturing Co., Inc., who spoke on "Bright Cyanide Copper Plating."

One new member was elected.

John Donaldson introduced the guests of the evening. **Ray Kilroy** was appointed chairman of the Sick Committee. The January meeting will be held Friday, January 8, at our regular meeting place. **C. H. Sample** of the International Nickel Co. will talk on "Corrosion Behavior and Protection Value of Electrodeposited Coatings."

Christopher Marzano, chief Chemist of the Amphenol-Borg Electronics Corp., will speak at the February meeting on "How to Plate Difficult Metals."

Robert E. Lienert
Secretary

CENTRAL MICHIGAN

Aluminum Conversion Coatings Presented by Thirsk

Central Michigan Branch held its first educational and dinner-meeting of the 1959–1960 year at the Hotel Roosevelt in Lansing, Michigan on Tuesday evening, Oct. 6.

Twenty-five members and guests attended. Following the dinner a brief business session was held, conducted by **Dave Trafelet,** president. Several communications from National Headquarters were read to the members by **R. W. Boos,** secretary-treasurer.

Speaker for the educational meeting was **James H. Thirsk** of the Amchem Products, Inc. Mr. Thirsk spoke on the "Principles and Practices for the Development of Chemical Conversion Coatings on Aluminum."

Homer E. Welch
First Vice President and Publicity Chairman

CHICAGO

Pinner Explains AES Research Project 15

The October meeting of the Branch was held at Stella's Restaurant on Friday, the 9th. **Ed Smith** is to be commended for his remarkable job on the Golf Outing which was held at the Itasca Country Club. Six memberships were approved by the Board of Managers and two new memberships were received. All members were urged to attend the first annual conference of the Midwest Regional Council at Rockford on Saturday, Nov. 7.

Two visitors from Spain attended the meeting. **Simon Gary,** librarian, introduced the speaker of the evening, **Walter L. Pinner** of the McGean Chemical Co.

Mr. Pinner, a past president of the AES, has been very active in the electroplating and finishing field. He has served on many committees and recently as chairman of AES Project No. 15. His subject was a report on the project. Mr. Pinner commented that the salt spray results were indefinite and weather exposure tests were much too long. The project then undertook the job of developing some useful tools for measuring plating quality of the copper-nickel-chrome and nickel-chrome plating systems. For this purpose, numerous panels were plated and exposed during the winter in the Detroit area. The panels, the size of license plates, were placed on the front bumpers of cars so that they were exposed to snow, slush, rain, salt, dirt, etc., during the test. Similar plated panels were also sent to Pittsburgh, Cleveland, Florida for a comparison check. It was found, that the *p*H of the slushes collected in bottles, on the front end of the cars, had a *p*H of 2.5–5.0. Metals such as copper and iron were always present in the slush and air-borne dust. After many tests, Formula 59 was developed which reproduced the same result as the panels exposed during the winter. Formula 59, a paste, consisted of kaolin, water, copper chloride and ferric chloride. The test (Corrodkote) procedure was as follows: (1) the surface was painted with the paste (2) allowed to dry for one hour (3) placed in humidity cabinet at 100F for 24 hours (4) the paste washed off the panel and examined for rust spots. The Corrodkote test can be used to predict the service life of parts to a period of one year.

Project No. 15, under guidance of Mr. Pinner, also developed the Cass Test which gave the same result on panels, as to type and extent of corrosion as the Corrodkote Test. The test ran for 16 hours at 120F ±2° and consists of a 5 per cent sodium chloride solution containing 0.5 per cent glacial acetic acid and 1.1 gm/gallon of copper chloride. This test can predict the service life of parts for a period longer than a year. Mr. Pinner concluded that the two tests arrive at the same end point and can prove to be useful tools to measure plating quality for the plating industry. After a lively question and answer period, Mr. Pinner was given a rising vote of thanks for his interesting and informative talk.

Christopher Marzano
Publicity Chairman

BRANCH SECRETARIES

Branch News is required of all Secretaries monthly by AES Bylaws. First of the month is Branch News deadline for next PLATING issue. Any items on hand on that date will be carried in that edition. Later arrivals will appear in the issue immediately following. In reporting talks given by speakers before the Branch, please give titles of the talks, the speakers' full identification and any other pertinent information of interest to other Branches and PLATING's broad readership.

COLUMBUS
Winters Speaks on Anodes

The regular monthly meeting was held on Friday, Oct. 9, at Ricardo's Restaurant.

Following the dinner a short business meeting was held at which a new member was elected.

The 28 members and guests present heard an interesting account of "The Anode's Side of the Story" from guest speaker **J. B. Winters** of Incar, Inc., Cleveland, Ohio. His talk was followed by an enthusiastic question period.

Leslie D. McGraw
Secretary

DALLAS-FORT WORTH
Chemical Milling Presented by Hammond

The Dallas-Ft. Worth Branch had its October monthly meeting at Semos Restaurant in Dallas on Oct. 21. In the absence of President **Browning** and First Vice President **W. L. Aves,** the meeting was presided over by **A. C. Fricke,** secretary-treasurer. Approximately 27 members and guests were in attendance.

After a short business meeting wherein the approaching Aerospace Finishing Symposium was discussed, Mr. Fricke introduced our guest speaker, **Lee Hammond,** Turco Products Inc., Chem-Mill Division. Mr. Hammond presented a paper entitled "Chemical Milling Techniques for Honeycomb Core." He explained some of the processing techniques, newly developed by the Chem-Mill Division of Turco Products, Inc., for use in the aircraft industry. His very enlightening talk was augmented with colored slides.

T. E. Betz
Recording Secretary

GRAND RAPIDS
Hill Talks on Copper Plating; Charter Member Werft Attends

The first 1959–60 meeting of the Grand Rapids Branch was held on Friday, Sept. 11 at Scottie's Restaurant. Our speaker for the evening was **Ward Hill,** of DuPont. His talk dealt with the subject of "Modern High Speed Alkaline Cyanide Copper Electroplating". Mr. Hill has been the DuPont representative from the electrochemicals department in Western Michigan for well over 25 years and he was able to give some timely remarks as the result of his experience. Color slides showing typical installations were used as technical aids to Mr. Hill's presentation.

In attendance at our first meeting of the new season was **Charles Werft,** a Charter Member of the Grand Rapids Branch who instituted some years ago the Charles Werft Memorial Fund, amounting to $500.00. Mr. Werft moved that interest accumulated on his fund in the amount of $126.00 be employed to pay dues for those members of the Electroplating Fraternity unable to support their own membership. Mr. Werft asked that the recommended dues payment plan be restricted to those members actively engaged in electroplating, as such.

HARTFORD
Gurski Speaks on Automotive Plating

The regular meeting was held at the Veterans of Foreign Wars building on Sept. 21 and 44 members and guests were present. Preceding the meeting a movie in color entitled "Finishes for Aluminum" was shown.

The guest speaker for the evening was **Joseph Gurski** of the Ford Motor Co., whose subject was "Plating Applications to Automotive Parts".

Various plated coatings are selected for the usefulness that they will serve: as zinc and cadmium for corrosion resistance, anodized layers on aluminum and chromium on piston parts for resistance to wear, decorative chromium with copper and nickel underneath, to prevent scouring and galling tin and copper are used on steel, for soldering and brazing parts are plated with tin for ease of soldering, copper is plated for stop-off in carburizing and tin or bronze or nickel as stop-off for nitriding. Specifications for most auto dealers are the same. Various testing methods are employed as visual, adhesion, salt spray, thickness, Corrodkote, drop tests, Magne-Gage, microscopic, acetic acid corrosion test. Factors affecting the quality of the plate are processing methods, design, plating thickness and poor cleaning techniques.

The technical chairman for the evening was **Arnold Johnson.**

Stanley Platoz
Secretary

Photo courtesy Hanson-VanWinkle-Munning Co.

STOP CORROSION and CONTAMINATION

Where you use corrosive acids and other chemicals for pickling and metal plating be sure it's Manhattan Rubber Linings that protect your costly equipment. Thick, multiple calendered sheets of natural or synthetic rubber are bonded to tank metal so securely they can't be separated! Manhattan Rubber Linings eliminate the dangers of stray currents in plating operations. They expand and contract with metal . . . won't harden, crack or oxidize — even under extreme temperature change. To assure lifetime protection, every Manhattan rubber lined tank is tested under high voltage to detect any possible imperfections before being shipped.

Get the kind of *permanent protection* that has kept many Manhattan Rubber Lined tanks in continuous use over thirty years. Specify "Manhattan" on your equipment. Contact the Manhattan rubber lining facilities nearest you.

MULTIPLE CALENDERED SHEETS
•
PERMANENT RUBBER-TO-METAL BOND
•
POSITIVE PROTECTION FROM STRAY CURRENTS

RM-824

RUBBER LINING PLANTS AT PASSAIC, N. J. • NORTH CHARLESTON, S. C.

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY
RAYBESTOS-MANHATTAN, INC.
Manufacturers of Mechanical Rubber Products • Rubber Covered Equipment Radiator Hose
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INDIANAPOLIS

Striving for New Sustaining Members

Ladies' Nite was observed at the October meeting on Tuesday the 6th, at the Central Park Cafeteria, Arvin Industries, Columbus, Indiana. Seventy dinners of delicious steak and all the trimmings were served. President **Les Reynolds** presided.

It was moved by **Quentin Shockley** that we do not have the annual spring dinner-dance. **Loren Stevens** seconded the motion and it was passed.

Our president gave a brief report of his trip to Detroit to attend the meeting of the National Membership Committee, of which he is chairman. He stated that we should be proud to be a member of the AES and that pins are available to wear as a member. Pins will be awarded to new members when they become members.

We have a new sustaining member—Western Electric Company. This announcement was met with a hearty round of approval. We are trying to get five or six additional sustaining memberships.

The November meeting will be at the Delco-Remy Plant in Anderson of which the Branch will be dinner guests.

The program for the evening was put on by the "Better Business Bureau" of Indianapolis. A film was shown by **Hugh Meyers** showing how easy it is for public to be deceived by so many people selling almost everything nowadays. He told how his office is set up to help individuals as well as businesses to find true information about this type of malpractice. Millions of dollars are lost each year by the public through fraud and deception in business which might include selling cars, house insulation and siding, driveways, etc. He told about the costs of belonging to the bureau and the evening proved very enlightening. Many of the audience asked questions about just this sort of people who had called on them in the past with some kind of fraudulent business.

The meeting adjourned at 9:20 p.m.

Edna Rohrabaugh
Secretary

KANSAS CITY

Lee Presents Electroless Nickel; Safety Discussed by Hartz

The regular meeting for the month of September was held at Regans' Restaurant, 207 Southwest Boulevard, on Thursday, Sept. 16. The officers and executive board met at 5:45 p.m. and considered several items of business. After discussion, it was agreed to fix the annual dues at $11.00 to cover the increase in per capita tax. This was subsequently submitted to the entire membership for a vote. The proposal carried.

R. L. Garrett, R. C. Garland, and **Milo Sawyer** were appointed a committee to revise the bylaws of the Branch and submit them at a later meeting for consideration. **Warren Eliot,** first vice president and chairman of the membership committee, urged all members to supply him with the names of any and all prospective members so that they might be contacted.

At 7:00 p.m., 23 members and guests were served a delicious filet dinner. Announcements were made by the president, **Scott Sterrett.** Librarian **William DesJardins** introduced the first speaker, **R. E. Lee,** our own member from Chromium, Inc. He spoke briefly on "A Summary of Applications of Electroless Nickel." Mr. Lee's talk based on his brief experiences and study of the newest process in use in his company was well received.

Bill DesJardins then introduced **John S. Hartz,** sales engineer of Mine Safety Appliances. Mr. Hartz spoke on the subject, "Health Hazards and Safety in Plating Operations." He showed and demonstrated a complete line of safety devices furnished by his company and discussed their merit for both temporary and permanent solutions to hazards in shops. Following his formal talk, Mr. Hartz answered questions from the group and continued his discussion with individuals even after the meeting was concluded.

Robert L. Garrett
Secretary

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KANSAS CITY

Minert Speaker at First Organic Finishing Program

The first program in the field of organic finishing for the Kansas City Branch was held on Thursday, Oct. 15. Twenty-five members and guests assembled in the Topic Room of Regans' Restaurant at 7:00 p.m. and enjoyed a delicious fried chicken dinner. During the usual after-dinner break the speaker arranged on the head table an impressive array of multi-colored panels and test tubes.

When all was ready, Librarian **Bill DesJardins** introduced **Ken Minert** of the new products development section of the Cook Paint and Varnish Company. Mr. Minert entitled his presentation "The Coatings Revolution." He outlined the basic fundamentals in the manufacture of paints prior to 1950, mentioning the various materials which were available for pigments and vehicles and the more or less conventional coating systems. The second part of his talk was concerned with the "Elements of a Protective Coating." The most interesting portion of his speech was his enumeration and discussion of materials and application methods which have been developed and come into use since 1950. These included latex, epoxy, phenolic, vinyl, polyester, acrylic, neoprene, and other similar materials. Mr. Minert concluded with a look at the future of coatings and mentioned some of the things which are or are soon to be developed.

Delegates and Alternates named are: Delegates—**R. C. Garland, W. A. McGee** and **A. C. West.** Alternates—**J. R. Thompson, Warren Eliot** and **Glen Wilson.** Any members of the Branch who may attend the Dallas-Ft. Worth meeting in December were empowered to act for the Branch in the forming of a Regional Group.

Robert L. Garrett
Secretary

LOS ANGELES

Panel Discusses Electroless Nickel

The Sept. 9 meeting was opened by President **George Hetz.**

Visitors were introduced by Librarian **Clare Ver West.**

Tony Stabile reported on the progress of the 1960 convention with appropriate tribute to the fine work of our late member, **Marty Barsoom.** The newly appointed Housing Chairman is **Norman Painter.**

New petitioners were introduced by **Frank Virgil.** One new member was initiated by President Hetz.

Our librarian, **Marjorie Farmer,** introduced the panel for the evening educational session. They were **Willard Bell, Martin Yardley** and **Bert Sherwood,** who talked on electroless nickel plating.

H. K. Hunt
Secretary

LOS ANGELES

Diggin Talks on Nickel Deposition

The Oct. 14 meeting was conducted by President **George Hetz.** Librarian **Clare Ver West** introduced 13 visitors.

Dave Seymour reported on Handbook Committee progress. **Oscar Grisat** reported for the Research Committee. He supplied the names of two new sustaining members: Ajax Hardware Mfg. Co. and Royal Plating.

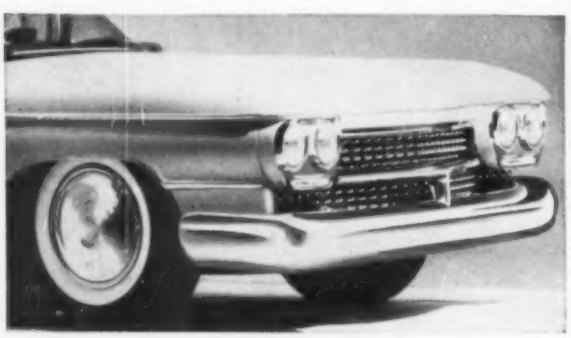
Norman McEwan reporting for the board of managers stated the new Phoenix Branch would like to form a regional group to include Los Angeles, San Francisco and possibly other Branches.

It was moved, seconded and unanimously voted that we do not have Branch exhibits at the 1960 convention.

The following delegates to the 1960 convention were elected: **Glenn Beckwith, Don Baudrand, Earl Coffin.** Alternates were **Stuart Krentel, Larry Henderson** and **Don Bedwell.**

Librarian **Marjorie Farmer** introduced the speaker of the evening, **Myron Diggin,** who talked on durable nickel deposits.

H. K. Hunt
Secretary



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MIAMI

Lead Anodes Discussed by Schlundt

The regular monthly meeting and educational session was held Oct. 16 at our new headquarters: 5000 East 10th Court, Hialeah, Fla.

The speaker of the evening was **Lou Schlundt** of Republic Lead Equipment Co., Cleveland, Ohio.

Mr. Schlundt discussed the use of round and hollow lead anodes for chromium plating and the joining of metals by the homogeneous method.

The article written by **Henry R. Friedberg,** and published in PLATING MAGAZINE July 1959, was brought into the discussion.

Were it not for the fact that some matters pertaining to the Technical Session, to be held at the Saxony Hotel, Miami Beach, Jan. 15 and 16, 1960 had to be considered, this discussion would have lasted until the wee hours of the morning.

Frank X. Marinello
Secretary and Treasurer

MONTREAL

Annual Dinner-Dance Gala Affair; Pettit Speaks at Regular Meeting

The Montreal Branch got its 1959–60 year well into orbit on the occasion of its fifth annual dinner-dance, held at the Queen's Hotel on Oct. 3. The evening started with a gala cocktail party given by Canadian Hanson and Van Winkle Company Limited. Following the dinner, numerous door prizes were awarded to the lucky ticket holders. The door prizes were contributed by the plating industry in the Montreal area. The enjoyable evening culminated with dancing until 1 a.m. to the orchestra of Ray Forget.

At the regular monthly meeting on Oct. 19 at the Sheraton Mount Royal Hotel, President **R. Takeuchi** called the meeting to order at 8:45 p.m. **J. Rennie** introduced **R. Pettit** of Diversey Corporation, speaker for the evening. Mr. Pettit gave a very interesting talk on Plating, Porcelain Enameling, Anodic Oxidization on Aluminum and its Alloys. He also showed some excellent slides of various plants and their operations. Mr. Pettit was thanked on behalf of the Branch by **C. Iwen.**

An application for membership was received and approved.

R. W. Niggemann
Secretary

NEW HAVEN

Logozzo Presents Chromium Plating

The Sept. 5 meeting of the New Haven Branch was held in the Guest Room of the New Haven Motor Inn.

President **O'Connor** welcomed the members present and opened the business session by making the following appointments: Sustaining Membership Committee, Dr. Edward Saubestre; Membership Committee, W. K. Murray; Regional Committee, George F. O'Connor Jr.; Sick Committee, James P. Creamer; Entertainment, Vincent Capuano.

The president of the Nutmeg Chrome Corp., **Arthur Logozzo,** was the speaker of the evening. He covered the evolution of various chromium plating baths and discussed the latest advances in hard chrome plating. He showed the relationship between temperature, current density and bath composition and the effect these variables will have on the hardness and stress properties of the chromium deposit. The adverse effects of excessive trivalent chromium was discussed in regard to the gray, nodular appearance of the plate. An instructive film on a specialized segment of the hard chrome plating industry was shown. Objective questions were asked and helpful answers were given following the prepared talk.

B. J. Gaffney
Secretary-Treasurer

NEW HAVEN

Color Anodizing Discussed by Darrow

The New Haven Branch met Tuesday, Oct. 13, at the New Haven Motor Inn. Following the regular business meeting, Technical Chairman **Adam Walsh** intro-

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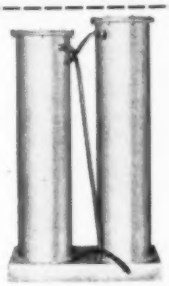

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duced the speaker of the evening, **G. R. Darrow** of the Reynolds Metals Co., who spoke on "The Six Steps to Successful Color Anodizing."

The attending members and guests agreed that Mr. Darrow's presentation of his topic was one of the best heard in New Haven in many years. The lengthy question period following the talk was indicative of an interested audience.

The Door Prize donated by **Jack Barry** of the Fred Gumm Chemical Co., was won by **Carl Seivert** of Hubbard-Hall.

William E. Bridgett
Historian

PHILADELPHIA

Rinker Talks on Precious Metal Plating; Meeting Place Change

The regular meeting of the Philadelphia Branch was held at the Engineers' Club on Oct. 26 with 38 at dinner and about 75 at the meeting. Visitors included Newark Branch Secretary **Dr. D. G. Foulke** and **John Trumbour** of *Metal Finishing*.

In order not to delay the speaker, Branch business was deferred and Librarian **Berenato** introduced **Edwin C. Rinker,** Sel-Rex Corporation, whose topic was "New Developments in Precious Metal Electroplating." Mr. Rinker's talk was a comprehensive description of the development and use of modern rhodium, platinum and gold plating solutions. He covered their uses in industrial applications, as well as their decorative requirements.

The business meeting resumed at 10:00 p.m., with the admission of three new active members. Considerable debate took place on the question to move the Branch meeting place from the Engineers' Club. In reply to the questionnaire sent to the members with the October Reminder, a tabulation of the 68 returned showed 52 in favor of moving and 16 not in favor. Of the 52 in favor, 44 were in favor of Beck's Restaurant on Roosevelt Boulevard as the Branch meeting place. Motion was passed that action to amend the Branch Bylaws to change the meeting place be taken at the November meeting.

I. Wm. Marcovitch
Secretary

PHOENIX

Permanent Charter Presentation Ceremony

At a properly impressive ceremony held at a dinner meeting at the Valley Ho Resort Hotel, Scottsdale, Arizona, Friday, Oct. 9, the Phoenix Branch was presented with their permanent charter.

The installation team consisted of **Ralph D. Wysong,** Studebaker-Packard Corp. and president of the AES and **John P. Nichols,** National Executive Secretary.

Dr. Clyde Crowley, head of chemistry department, Arizona State University, long time AES member and formerly with Graham, Crowley and Associates, acted as master of ceremonies. Dr. Crowley introduced several noted guests including Governor and Mrs. Paul Fannin, Mayor and Mrs. Jack Williams, Dr. Merle C. Nutt, head of metallurgy department, A.S.U.; several out-of-state guests were present, including Mr. and Mrs. **Lawrence O'Neil,** Le Hommedieu & Sons Co., Los Angeles—Larry is publicity chairman for the AES 1960 Convention in Los Angeles, and **Gene H. Weiner,** Shipley Company Inc., Boston, Mass.

It would not be possible to list all the distinguished guests, especially since all of the 100 guests present could be so considered.

Executive Secretary John P. Nichols spoke on the value of the AES to industry, the member and to society.

Branch Secretary **James Weaver** gave the history of the formation of the Phoenix Branch and President **William Griff** introduced the Branch officers.

National President Ralph D. Wysong welcomed the Phoenix Branch into the Society and presided at the induction of the Branch officers.

Brief speeches were given by Governor Fannin, Mayor Williams and Dr. Lester Hogan. The event concluded with dancing and festivities with music by Frank Pratt and his Combo.

James Weaver
Secretary

PITTSBURGH

Death of Leo Schmitt Sr. Announced

The Branch met Oct. 14 at the Gateway Plaza. Regular meetings are held on the second Wednesday of the month.

There were two elections. Two In-Transfer members attended their first Pittsburgh regular meeting—**Walter L. Guiltinan** of H-VW-M Company and **Jim Stettler** of Textiles Cleaning Products.

We regretfully announce the passing of **Leo Schmitt Sr.** of the Cowan Mfg. Company. As a member of the AES and participant in the electroplating field, Leo made the name of Schmitt and the word "respect" synonymous.

E. Keller
Secretary

PROVIDENCE-ATTLEBORO

Chace Presents Paper on Lacquers

The second meeting of the year was held Oct. 19 at the Providence Engineering Building on Angell Street.

Mr. Noonan discussed the Christmas Party plans which is to be held Dec. 7 at the Wayland Manor.

After a short business meeting the speaker of the evening, **W. W. Chace** of Agate Lacquer Company, discussed "Lacquers and Their Applications." A considerable number of questions developed as this subject had not been discussed for at least ten years before the local Branch.

Edward A. Parker
Secretary

ROCHESTER

Round Table on Plating Problems

The Oct. 5 meeting of the Rochester Branch was opened by Second Vice President **John Cippola** at the Rochester German Club. After dispensing with the routine business affairs of the Society, the meeting was turned over to **Frank O. Beuckman,** who acted as moderator for a round table discussion of plating problems. Following an active discussion by all present, refreshments were served through the courtesy of Don Blum Associates.

Barrie M. Gardner

SAINT LOUIS

Wagner Talks on Duplex Chromium

The first fall meeting was held Oct. 14 at the York Hotel. There were 27 members and guests for dinner and 37 present when President **William Piel** called the business meeting to order. Three new members were voted into our Branch unanimously.

The Midwest Regional conference at Rockford was discussed and it was pointed out that **Andy Julius** was serving on the finance and registration committee and **Craig McAlister** was on the inorganic panel of the workshop session.

The following members were selected as delegates to represent our Branch at the Los Angeles convention: A. P. Julius, **Louis J. Berra** and William Piel; alternates: Craig McAlister, **William George** and **Henry Siegel.**

Ed Sertl reported that our plating school is again in full attendance with 28 in this fall's class. Otto Klein, the instructor, had to go into the hospital for an operation and Andy Julius took over the class for two weeks. The entertainment committee for the coming year was appointed: Eugene Conroy, chairman; Frank Menniges and Louis Berra. A short discussion about the 1964 convention followed. It was pointed out that our riverfront memorial and the new sports stadium would probably be finished by then. **Richard Gotsch** introduced the speaker of the evening, **Karl Wagner,** technical service representative of Metal and Thermit Corp. who talked on Duplex Chromium. His talk was accompanied by slides showing the superior corrosion resistance of the duplex chromium. He also covered the corrosion tests used in the preparation of the slide material.

Ward Kelly
Secretary

SOUTHERN TIER

Helbig Talks on Activated Carbon

The regular monthly meeting was held Oct. 20 at the American Legion Post, Vestal, N. Y. Approximately 30 members and guests were in attendance at both the dinner and technical session. Guests in attendance were **D. Blum** and **F. Thiem** of the Rochester Branch; K. Cornell,

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M. Ibrie, G. Blanchard of Scintilla Bendix Aviation Corp.; E. Bucher, L. Todd, J. Hodak, D. Brownell, General Electric Co.

The following members were elected as delegates to the 1960 convention: **J. Bunsic, C. Bound, M. Rake**; alternates: **A. Fletcher, G. Zurenda, H. Harper.**

J. Bunsic and **E. Brewer** were elected co-chairmen of the annual Branch Christmas party.

A report of the progress of the New York State Regional was given by the co-chairmen, **S. Stefanski** and M. Rake.

Librarian **A. Andreason** introduced this evening's speaker, **Walter Helbig** representing the Atlas Powder Co. His topic, The Use of Activated Carbon in the Filtering and Treatment of Plating Solutions, proved very interesting and much valuable know-how was gained.

Mr. Helbig described the two methods being used today for filtration and treatment of plating solutions as 1) precoating of filters, 2) contents of plating solution pumped to reserve tank, treat and filter and return.

In summarizing reasons for filtration and activated carbon treatments of plating solutions, Mr. Helbig states that very clean metal surfaces will pick up or adsorb impurities if present and cause non-uniformity of electrodeposition of metal from the plating bath.

B. Rossiter
Secretary

SPRINGFIELD
Langston Talks on Stress Relief

The Springfield Branch met at Blake's Restaurant, on Monday evening, Oct. 26, for the regular monthly meeting, which was opened by **Alexander R. Salmond,** first vice president, in the absence of President **Elery C. Gibson.** Mr. Salmond gave a brief report of the New England Regional Committee Meeting. Springfield will have charge of the entertainment program this coming year.

The secretary read a letter received from the Dallas-Ft. Worth Branch on the coming symposium in December.

The Branch Secretary notified the membership present that an old time friend and loyal member of the Springfield Branch had sent in a letter of resignation. **Norman F. Plank,** the only one of the group from Pittsfield to remain as a member of the Springfield Branch when the Capitol District Branch was formed will be missed by the many who knew him. It was suggested the Branch secretary write Norm a letter of appreciation, to be signed by all his friends of the Springfield group at the next meeting.

The Branch secretary gave a brief report of the Valley Council of Technical Societies, of which the Springfield Branch, AES, is a member. **Roger Heroux** gave his opinion on the value of remaining in the Council. The matter was referred to the board of managers for a decision.

Librarian **Louis E. Dupuis** introduced the technical chairman for the evening, **Robert Girard,** who said a few words of welcome, and then proceeded to outline the background of the speaker for the evening. **Henry Langston** is chief metallurgical engineer for Hamilton Standard Division of United Aircraft Corporation, and formerly was chief of the Springfield Armory Laboratory. He spoke on Stress Relief on Parts Prior to Plating. The subject was timely and well received, as evidenced by the lively discussion and the questions that came up during the talk. As usual, the stay-at-homes didn't learn a thing.

Henry L. Heissfeld
Secretary

WATERBURY
McTeague Explains New Plastic Coatings

The Waterbury Branch had its regular October meeting at the Roger Smith Hotel on Thursday the 8th. The nominating committee presented its slate of Delegates and Alternates to the National Convention for action by the meeting. The complete slate was elected. Delegates: **P. Sloane, W. Geisker, F. Tirendi**; alternates: **W. Innes, E. Couch, F. Schneiders.**

The entertainment committee under **Lou Porretti** and **Nick Topazio** is formulating plans for our annual social evening to be held in February.

The speaker of the evening was **R. F. McTeague,** technical director, Stanley Chemical Co. He spoke of "New Plastic Coatings for the Electroplating Industry." His talk outlined the methods for fabricating the many objects being made out of plastisols and related compounds.

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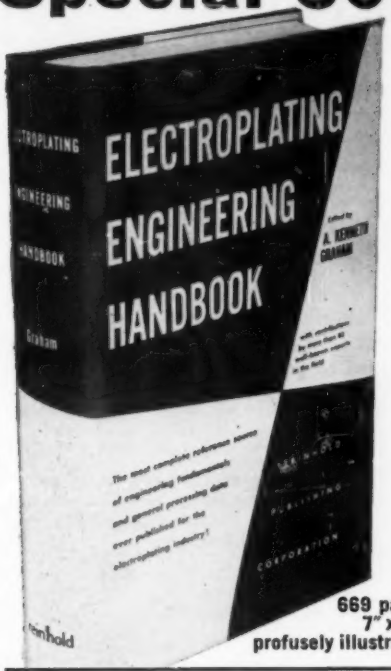

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The St. Louis Branch will have P. N. Burkhard of Wyandotte Chemicals Corporation as the featured speaker at its December 9 meeting at the York Hotel. Mr. Burkhard is head of Wyandotte's Industrial Railroad and Aircraft Departments. His subject will be "The Recent Developments in Metal Cleaning."

Dinner is at seven, the meeting starts at eight o'clock.

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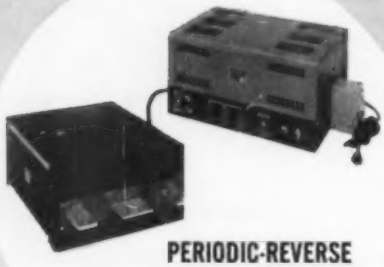

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December 4-5, 1959—**Detroit Branch,** Annual Meeting—National Officers Night—Symposium on Nickel Plating, and Christmas Dinner Party and Dance, Statler-Hilton Hotel, Detroit.

December 8-9, 1959—**Dallas-Fort Worth Branch,** cosponsored with the Southwest Society of Aircraft Materials and Process Engineers, Symposium on "Treatments and Finishes for Aerospace Materials," Hotel Texas, Fort Worth, Texas.

December 10, 1959—**Kansas City Branch,** National Officers Night, Speaker—National President Ralph D. Wysong, Regan's Restaurant, 207 Southwest Blvd., Kansas City, Mo.

December 11, 1959—**Newark Branch,** Educational Session, Hotel Robert Treat, Newark, N. J.

December 12, 1959—**Newark Branch,** Annual Christmas Party, Hotel Robert Treat, Newark, N. J.

January 15-16, 1960—**Second Annual Dixie Regional Technical Session,** Saxony Hotel, Miami Beach, Florida. Sponsored by Miami Branch with Blue Ridge and Southeastern participating.

January 23, 1960—**Grand Rapids Branch,** Annual Educational Session and Dinner Dance, Pantlind Hotel, Grand Rapids Mich.

January 29, 1960—**Editorial Board Meeting,** Conrad Hilton Hotel, Chicago, Ill.

January 30, 1960—**Chicago Branch,** Annual Meeting and Banquet, Conrad Hilton Hotel, Chicago, Ill.

February 6, 1960—**New York Branch,** Annual Educational Session and Dinner-Dance, Statler-Hilton Hotel, New York, N. Y.

February 18, 1960—**Research Committee Meeting,** Ben Franklin Hotel, Philadelphia, Pa.

February 19-20, 1960—**Seventh Interim Meeting,** Philadelphia Host Branch, and Golden Anniversary Educational Meeting and Banquet of Philadelphia Branch, Ben Franklin Hotel, Philadelphia, Pa.

February 19 & 21, 1960—**Executive Board Meeting,** Ben Franklin Hotel, Philadelphia, Pa.

April 8-9, 1960—**Executive Board Meeting,** National Headquarters, Newark, N. J.

April 23, 1960—**Sixth Tri-State Regional Meeting,** Cincinnati Host Branch, Sheraton-Gibson Hotel, Cincinnati, Ohio.

April 23, 1960—**Twenty-First Annual New England Regional Meeting,** Bridgeport Host Branch, Hotel Statler, Hartford, Conn.

FUTURE MEETINGS

April 29-30,	**1960—Sixth Empire State Regional,** Southern Tier Host Branch, Mark Twain Hotel, Elmira, N. Y.
July 24-28,	**1960—47th AES Annual Convention,** Hotel Statler, Los Angeles, Calif.
Sept. 17,	**1960—Boston Branch Annual Educational Meeting and Banquet,** Hotel Statler, Boston, Mass.
February 3-4,	**1961—Third Annual Dixie Regional Technical Session,** Hotel Roanoke, Roanoke, Virginia. Blue Ridge Host Branch.
June 18-23,	**1961—48th AES Annual Convention,** Hotel Statler, Boston, Mass.
June 25-28,	**1962—49th AES Annual Convention,** Schroeder Hotel, Milwaukee, Wis. Sponsorship Midwest Regional Council.
June 24-27,	**1963—50th AES Annual Convention,** Ambassador Hotel, Atlantic City. N. J. Sponsorship Newark Branch.
June 21-25,	**1964—51st AES Annual Convention,** St. Louis, Missouri

INTERSOCIETY

January 12-15,	**1960—Society of Plastics Engineers**—16th Annual Technical Conference, Conrad Hilton Hotel, Chicago, Ill.
January 26-27,	**1960—Society of Vacuum Coaters** Third Annual Meeting, Hotel Biltmore, New York City.
February 1-5,	**1960—American Society for Testing Materials,** Committee Week, Sherman Hotel, Chicago, Ill.
February 1-5,	**1960—Instrument Society of America,** Instrument-Automation Conference and Exhibit, Houston Coliseum, Houston, Texas.
March 14-18,	**1960—National Association of Corrosion Engineers,** 16th Annual Conference and 1960 Corrosion Show, Dallas, Texas.
May 1-5,	**1960—The Electrochemical Society,** Spring Meeting, LaSalle Hotel, Chicago, Ill.
May 9-13,	**1960—American Society for Metals,** 2nd Southwestern Metal Exposition and Congress, State Fair Park, Automobile Building, Dallas, Texas
June 26-July 1,	**1960—American Society for Testing Materials,** 63rd Annual Meeting (with Apparatus Exhibit), Chalfonte-Haddon Hall, Atlantic City, N. J.
July 24-26,	**1960—National Association of Metal Finishers,** 5th Anniversary and Membership Meeting, Hotel Statler, Los Angeles, California.
July 25-26,	**1960—National Association of Metal Finishers,** 5th Anniversary Management Seminar, Hotel Statler, Los Angeles, California.

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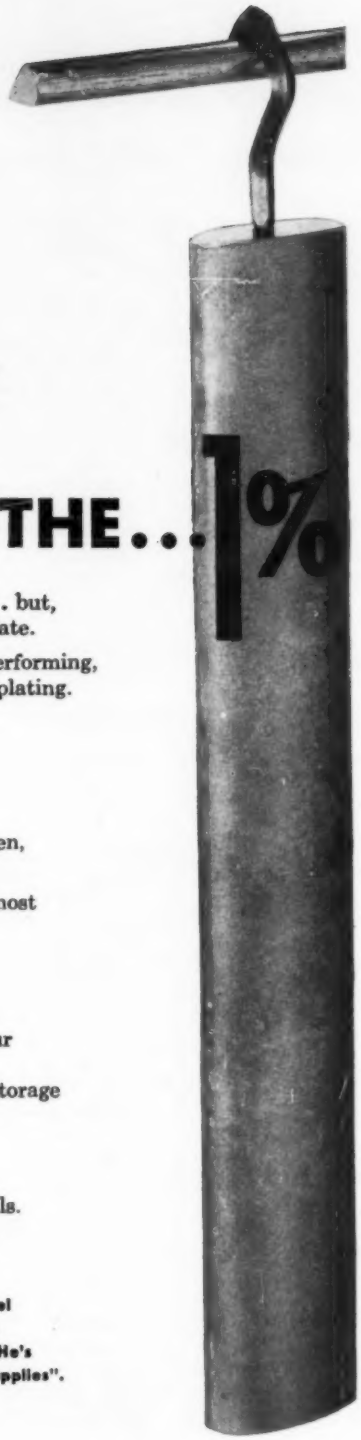

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INDEX TO VOL. 46 PLATING 1959

Page

A

Abrasion Resistance of Thick Anodic Coatings on Aluminum, A Method for Determining, B. E. Deal ... 823
Abrasive Belt Performance Influenced by Several Factors, R. W. Reed ... 27
Abrasive Media, Mechanical Finishing Using Flowing, C. H. Castle ... 31
AC Ripple In Rectifier Output, F. A. Schneiders ... 1279
Adhesion of Thick Electrodeposits, Evaluation of, H. Chessin and J. G. Poor ... 1037
Aerospace Finishing Symposium ... 1289
AES
- AES Ladies and the Golden Jubilee Convention, F. M. Hoffman ... 949
- Annual Report ... 665
- Boards and Committees ... 681
- Branch Delegates ... 679
- Branch Directory ... 683
- Constitution of the American Electroplaters' Society ... 1066
- Financial Report ... 1076
- Golden Jubilee Convention and Exposition Earn International Attention ... 937
- Golden Jubilee Convention Program ... 56, 169, 231, 397, 499, 691
- Interim Meeting Reporter (1959) ... 55, 168, 279
- Interim Meeting Reporter (1960) ... 1385
- International Conference Programm ... 282, 399, 501, 693

Introduction to Fundamental Research on the Mechanism of the Electrodeposition of Metals, An, B. E. Conway and J. O'M. Bockris. AES Research Project No. 16 ... 371
Milestone of AES, W. Blum ... 363
Milestones of AES, J. P. Nichols ... 50, 162, 269
Paper Award Winners ... 847
Phoenix and Denver Installed ... 1285
Proctor Award Established ... 952
Proposed Changes in the AES Constitution ... 396

AES Research
- AES Research Projects ... 362, 750
- AES Project No. 12—Cleaning and Preparation of Metals for Electroplating (Summary) ... 365
- AES Project No. 12—Cleaning and Preparation of Metals Prior to Electroplating XII. Effect of Fatty Acid Film, H. B. Linford and J. J. Grunwald ... 1039
- AES Project No. 13—The Nature, Cause and Effect of the Porosity in Electrodeposits (Summary) ... 365
- AES Project No. 13—Nature, Case and Effect of the Porosity in Electrodeposits III Microscopic Detection of Porosity ... 831
- AES Project No. 13—The Nature Cause and Effect of the Porosity in Electrodeposits IV. Influence of Gas Bubbles on the Formation of Pores, F. Ogburn and D. W. Ernst ... 957
- AES Project No. 13—The Nature Cause and Effect of the Porosity in Electrodeposits V. An Evaluation of the Sensitivity of the Ferroxyl Test, F. Ogburn, D. W. Ernst and W. H. Roberts ... 1052
- AES Project No. 14—Accelerated Corrosion Tests (Summary) ... 366
- AES Project No. 14—The Influence of Physical Metallurgy and Mechanical Processing of the Basis Metal on Electroplating (Summary) ... 366
- AES Research Project No. 16—An Introduction to Fundamental Research on the Mechanism of the Electrodeposition of Metals, B. E. Conway and J. O'M. Bockris ... 371
- AES Project No. 16—Mechanism of Electrodeposition (Summary) ... 366
- AES Project No. 17—Microthrowing Power (Summary) ... 367
- AES Project No. 18—Mechanical Finishing of Metal Surfaces (Summary) ... 367

After the Golden Jubilee—What, R. D. Wysong (Editorial) ... 793
Alkaline Chlorination of Cyanide Wastes and Reduction of Chromium Wastes with Sulfur Dioxide, J. L. Beals ... 922
All Union Scientific/Technical Conference on Corrosion and Protection of Metals, Moscow (Abstracts of Papers), Part 1 ... 154
- Part 2 ... 262

Alloy Plating, Progress on I. Tungsten and Molybdenum Alloys, W. H. Safranek and L. E. Vaaler ... 133
Aluminum, A Method For Determining Abrasion Resistance Of Thick Anodic Coatings On, B. E. Deal ... 823
American Society for Testing Materials 1958 Proceedings (Books) ... 1029
Analysis of Sulfate in Chromium Plating Baths, Notes on, J. Ducey and G. McKinley ... 384
ASTM—Committee B-7—Report Of 1958 Activities, R. F. Hafer ... 838
ASTM Committee B-8 Report—Summary of Observations of Factors Influencing Adhesion of Organic Coatings to Chromium Plated Surfaces ... 261
ASTM, Semi-Annual Meeting Committee B-8, E. B. Saubestre ... 488, 1378
ASTM Standards, 1958 Book of, Part 2. Non-Ferrous Metals Specifications (Books) ... 456
1958 Book of ASTM Standards (Books) ... 720
Automatic Additions of All Chemicals to the Nickel Plating Baths, M. G. Osman ... 819
Automatic Flat Basket Plating, G. J. Marotta ... 1359
Aves, W. L. Jr.
- How Versatile Application Techniques For Gold Solve Aircraft and Missile Problems ... 1260

B

Barrel Finishing for Plating, M. M. Maynes ... 36
Beacom, S. E.
- Influence of Cathode Film Thickness on Leveling ... 814

Beals, J. L.
- Alkaline Chlorination of Cyanide Wastes and Reduction of Chromium Wastes with Sulfur Dioxide ... 922

Ben, M.
- Membership Drives: Boon or Bane? (Editorial) ... 1003

Beyer, S. J.
- Finishing Satin Chrome Built-In Ovens ... 463

Bibliography of Metal Finishing Wastes, 1958, D. G. Foulke ... 934
Biography
- Aves, W. L. Jr. ... 1263
- Beacom, S. E. ... 819
- Beals, J. L. ... 923
- Beyer, S. J. ... 466
- Bockris, J. O'M. ... 383
- Borlet, C. G. ... 887
- Branciaroli, J. P. ... 260
- Briggs, Janet Z. ... 1376
- Brown, B. F. ... 468, 1157
- Castle, C. H. ... 33
- Chessin, H ... 1038
- Cohen, B. ... 1267
- Conway, B. E. ... 383
- Day, R. V. ... 931
- Deal, B. E. ... 827
- Dettner, H. W. ... 480
- Domnikov, L. ... 483
- Dubpernell, G. ... 616
- Ducey, J. ... 384
- Ernst, D. W. ... 833, 958, 1053
- Foley, F. D. ... 1274
- Friedberg, H. R. ... 836
- Goodwin, P. S. ... 44
- Graham, A. K. ... 153, 842
- Gray Jr., R. M. ... 1170
- Grunwald, J. J. ... 1045
- Hanson, N. H. ... 918
- Heiser, F. A. ... 388
- Heizmann, J. R. ... 1172
- Horvick, E. W. ... 645
- Howard, A. M. ... 487
- Hyde, J. E. ... 388
- Kanning, E. W. ... 256
- Lamb, V. A. ... 1036
- Lardenoit, V. G. ... 1267
- Lawless, G. W. ... 1267
- Linford, H. B. ... 1045
- MacIntosh, R. M. ... 620
- Maines, L. D. ... 238
- Marotta, G. J. ... 1363
- McKinley, G. ... 385
- Murphy, E. B. ... 830
- Niedhammer, H. A. ... 252
- Ogburn, F. ... 833, 958, 1053
- Osman, M. G. ... 822
- Parker, E. A. ... 627
- Passal, F. ... 638
- Poor, J. G. ... 1038
- Reed, R. W. ... 30
- Riley, C. R. ... 928
- Roberts, W. H. ... 1053
- Rogers, L. R. ... 487
- Rosenberger, H. M. ... 1152
- Rowan, W. H. ... 149
- Safranek, W. H. ... 143
- Schneiders, F. A. ... 1281
- Schultze, H. W. ... 1376
- Seyb, E. J. ... 149
- Shoemaker, Dr. C. J. ... 1152
- Spraul, J. R. ... 1369
- Strauss, S. W. ... 468, 1051, 1157
- Swanton, W. F. ... 921
- Tippman, M. ... 1056
- Vaaler, L. E. ... 143
- Vlannes, P. N. ... 468, 1051, 1157
- Westfall, V. W. ... 246
- Winchester, C. L. ... 44
- Young, J. P. ... 1036
- Zabban, W. ... 918
- Zievers, J. F. ... 928

Blum, W.
- Milestones of AES ... 363

Bockris, J. O'M. and B. E. Conway
- Introduction to Fundamental Research on the Mechanism of the Electrodeposition of Metals, An, AES Research Project No. 16 ... 371

Books
- American Society for Testing Materials 1958 Proceedings ... 1029
- Cleaning and Passivation of Corrosion-Resisting Steels, L. Lowry and J. Thompson ... 722
- Coatings for Protecting Molybdenum from Oxidation at Elevated Temperature, E. S. Bartlett, H. R. Ogden and R. I. Jaffee ... 1209
- Delayed Failure and Hydrogen Embrittlement in Titanium, R. D. Daniels, R. J. Quigg and A. R. Troiano ... 456
- Determination of the Mechanical Properties of Aircraft-Structural Materials at Very High Temperatures After Rapid Heating, J. B. Preston, W. P. Roe and J. R. Kattus ... 181
- Effect of Cadmium Plating on SAE 4340 Steel in the Presence of Stress Concentrations at Elevated Temperatures, The, E. M. Kennedy Jr. ... 456
- Effect of Halide Addition to the Sulfuric Acid Pickling Bath, M. Haftel and W. L. Reichel ... 722
- Effect of Prior Creep on Mechanical Properties of Aircraft Structural Metals: Part 3—C110M Titanium Alloy, J. V. Gluck, H. R. Voorhees and J. W. Freeman ... 456
- Growth and Perfection of Crystals, R. H. Doremus, B. W. Roberts and D. Turnbull ... 456
- Growth of Chromium Coatings from Liquid Metallic Solutions, S. T. Wlodek and J. Wulff ... 1029
- Hydrogen Embrittlement of Plated Steel Springs, J. A. Gurklis, L. D. McGraw and C. L. Faust (Books) ... 1029
- Lubrication of Titanium, N. Fatica ... 456
- 1958 Book of ASTM Standards ... 720
- 1958 Book of ASTM Standards, Part 2. Non-Ferrous Metals Specifications ... 456
- Research for Coatings for Protection of Niobium Against Oxidation at Elevated Temperatures, E. C. Hirakis ... 1209

Borlet, C. G.
- Lost Opportunity (Editorial) ... 887
- Some Engineering Aspects of a Good Filtration System ... 932

Branciaroli, J. P.
- Modified Hull Cell ... 257

Brown, B. F., P. N. Vlannes and S. W. Strauss
- Progress in the Development of a Non-embrittling Cadmium Electroplating Process ... 467

Brown, B. F., P. N. Vlannes and S. W. Strauss
- Progress Toward The Development Of A Nonembrittling Cadmium Electroplating Process III. The Use of Triethanolamine In Cadmium Plating Solutions ... 1153

C

Cadmium
- Cadmium and Related References, A Critical Examination of the Ferrocyanide Determination of, H. M. Rosenberger and C. J. Shoemaker ... 1151
- Cadmium Electroplating Process, Progress in the Development of a Nonembrittling P. N. Vlannes, S. W. Strauss and B. F. Brown ... 467
- Cadmium Plating from Conventional Cyanide Solution, A New Economic Method of Treatment of Stainless Steels Prior to, L. Domnikov ... 481
- Progress Toward the Development of a Nonembrittling Cadmium Electroplating Process II. Use of Aliphatic Amino Acids as Complexing Agents in Aqueous Baths, P. N. Vlannes and S. W. Strauss ... 1046
- Progress Toward The Development Of A Nonembrittling Cadmium Electroplating Process III. The Use of Triethanolamine In Cadmium Plating Solutions, P. N. Vlannes, S. W. Strauss and B. F. Brown ... 1153

Castle, C. H.
- Mechanical Finishing Using Flowing Abrasive Media ... 31

Cathode Film Thickness on Leveling, Influence Of, S. E. Beacom ... 814
Check Sheet For Motion Analysis, Using M-T-M Symbols, J. R. Heizmann ... 1172
Chemical Nickel, Corrosion Data for, J. R. Spraul ... 1364
Chessin, H. and J. G. Poor
- Evaluation of Adhesion of Thick Electrodeposits ... 1037

Chlorination of Cyanide Wastes and Reduction of Chromium Wastes with Sulfur Dioxide, Alkaline, J. L. Beals ... 922
Chromium
- Chrome Built-In Ovens, Finishing Satin, S. J. Beyer ... 462
- Chrome Plating Anodes, Lead Plating of, F. A. Heiser and J. E. Hyde ... 385

Page

Chromium for Better Corrosion Resistance, Thicker Decorative, E. J. Seyb and W. H. Rowan ... 144
Chromium Plating Baths, Notes on Analysis of Sulfate in, J. Ducey and G. McKinley ... 384
Chromium Plating, Lead Anodes For, H. R. Friedberg ... 834
Cleaning
Cleaning and Passivation of Corrosion-Resisting Steels, L. Lowry and J. Thompson (Books) ... 722
Cleaning and Preparation of Metals Prior to Electroplating XII. Effect of Fatty Acid Film, H. B. Linford and J. J. Grunwald—AES Research Project No. 12 ... 1039
Coatings for Protecting Molybdenum from Oxidation at Elevated Temperature, E. S. Bartlett, H. R. Ogden and R. I. Jaffee (Books) ... 1209
Committee B-7, American Society For Testing Materials—Report Of 1958 Activities, R. F. Hafer ... 838
Committee B-8, American Society for Testing Materials Semi-Annual Meeting, E. B. Saubestre ... 488, 1378
Continuous X-Ray Measurement of Plating Thickness, P. S. Goodwin and C. L. Winchester ... 41
Conway, B. E. and J. O'M. Bockris
Introduction to Fundamental Research on the Mechanism of the Electrodeposition of Metals, An, AES Research Project No. 16 ... 371
Cooperation, R. E. Harr (Editorial) ... 331
Copper
Copper Electroforming Of Heat Sinks For Missile Nose Cones, F. D. Foley ... 1268
Copper Plating During the Last Fifty Years, F. Passal ... 628
Corrosion Data for Chemical Nickel Plating, J. R. Spraul ... 1364
Corrosion Resistance of And an Evaluating Method for Various Electrodeposits on Steel, H. W. Dettner ... 469
Corrosion
Corrosion Data for Chemical Nickel Plating, J. R. Spraul ... 1364
Corrosion Resistance of And an Evaluating Method for Various Electrodeposits on Steel, H. W. Dettner ... 469
Corrosion Resistance, Thicker Decorative Chromium for Better, E. J. Seyb and W. H. Rowan ... 144
Courses, How Six AES Branches Conduct their Plating ... 494
Courses In Electroplating ... 1181
Critical Examination of the Ferrocyanide Determination of Cadmium and Related References, H. M. Rosenberger and C. J. Shoemaker ... 1151

D

Day, R. V.
Disposal of Plating Room Wastes ... 929
Deal, B. E.
Method For Determining Abrasion Resistance Of Thick Anodic Coatings On Aluminum, A ... 823
Decorative High Chloride Nickel Plating, M. Tippman ... 1054
Delayed Failure and Hydrogen Embrittlement in Titanium, R. D. Daniels, R. J. Quigg and A. R. Troiano (Books) ... 456
Design and Operation Problems of a Continuous Automatic Plating Waste Treatment Plant, N. H. Hanson and W. Zabban ... 909
Determination of the Mechanical Properties of Aircraft-Structural Materials at Very High Temperatures After Rapid Heating, J. B. Preston, W. P. Roe and J. R. Kattus (Books) ... 181
Dettner, H. W.
Corrosion Resistance of And an Evaluating Method for Various Electrodeposits on Steel ... 469
Dip System at American Motors, The Full Body, V. W. Westfall ... 241
Disposal of Plating Room Wastes, R. V. Day ... 929
Do It Now, H. E. Head (Editorial) ... 1229
Domnikov, L.
New Economic Method of Treatment of Stainless Steels Prior to Cadmium Plating from Conventional Cyanide Solutions ... 481
Dubpernell, G.
Story of Nickel Plating ... 599
Ducey, J. and G. McKinley
Notes on Analysis of Sulfate in Chromium Plating Baths ... 384

E

Eddy, F. T.
The Fiftieth Year (Editorial) ... 7
Editorial
After the Golden Jubilee-What?, R. D. Wysong ... 793
Cooperation, R. E. Harr ... 331
Do It Now ... 1229
Fiftieth Year, The, F. T. Eddy ... 7
Formula For Success ... 1125
Golden Jubilee: Beacon Pointing AES's Road Ahead, H. E. Head ... 555
Hypothetical Day, A ... 107

Page

International Exchange, W. A. Wesley ... 443
Lost Opportunity, C. G. Borlet ... 887
Membership Drives: Boon or Bane?, M. Ben ... 1003
Organic Finishing—Review and Preview, R. D. Wysong ... 211
Pause To Refresh, A, J. P. Nichols ... 1333
Educational Program, 47th AES Annual Convention ... 1282
Effect of Cadmium Plating on SAE 4340 Steel in the Presence of Stress Concentrations at Elevated Temperatures, The, E. M. Kennedy Jr. (Books) ... 456
Effect of Fatty Acid Film—Cleaning and Preparation of Metals Prior to Electroplating, H. B. Linford and J. J. Grunwald—AES Research Project No. 12 ... 1039
Effect of Halide Addition to the Sulfuric Acid Pickling Bath, M. Haftel and W. L. Reichel (Books) ... 722
Effect of Prior Creep on Mechanical Properties of Aircraft Structural Metals: Part 3—C110M Titanium Alloy, J. V. Gluck, H. R. Voorhees and J. W. Freeman (Books) ... 456
Electroforming Methods, Production of Embossing Plates from Texture Patterns by, J. P. Young and V. A. Lamb ... 1033
Electroplated Electrical Connections And Improved Through Hole Printed Wiring, E. B. Murphy ... 828
Electroplating of Tin Alloy Solderable Coatings on Ferrous and Non-Ferrous Basis Metals, A. M. Howard and L. R. Rogers ... 484
Electroplating Project Wins For Young Scientist ... 839
Electroplating Solutions, Filtration Of, R. M. Gray Jr. ... 1165
Ernst, D. W. and F. Ogburn
Nature, Cause And Effect Of The Porosity In Electrodeposits III. Microscopic Detection Of Porosity—AES Research Project No. 13 ... 831
Ernst, D. W. and F. Ogburn
Nature, Cause and Effect of the Porosity in Electrodeposits IV. Influence of Gas Bubbles on the Formation of Pores—AES Research Project No. 13 ... 957
Ernst, D. W., F. Ogburn and W. H. Roberts
Nature, Cause and Effect of the Porosity in Electrodeposits V. An Evaluation of the Sensitivity of the Ferroxyl Test, AES Research Project No. 13 ... 1052
Evaluation of Adhesion of Thick Electrodeposits, H. Chessin and J. G. Poor ... 1037

F

Fatigue Studies Of Plated Hot Work Tool Steels, G. W. Lawless, V. F. Lardenoit and B. Cohen ... 1264
Fiftieth Year, The, F. T. Eddy (Editorial) ... 7
Filtration Of Electroplating Solutions, R. M. Gray Jr. ... 1165
Filtration System, Some Engineering Aspects of, C. G. Borlet ... 932
Finishing Satin Chrome Built-In Ovens, S. J. Beyer ... 463
Foley, F. D.
Copper Electroforming Of Heat Sinks For Missile Nose Cones ... 1268
Formula For Success, W. A. Wesley (Editorial) ... 1125
Foulke, D. G.
Bibliography of Metal Finishing Wastes, 1958 ... 934
Friedberg, H. R.
Lead Anodes For Chromium Plating ... 834
Full Body Dip System at American Motors, The, V. W. Westfall ... 241

G

Gold Solve Aircraft and Missile Problems How Versatile Application Techniques For, W. L. Aves, Jr. ... 1260
Golden Jubilee: Beacon Pointing AES's Road Ahead, H. E. Head (Editorial) ... 555
Goodwin, P. S. and C. L. Winchester
Continuous X-Ray Measurement of Plating Thickness ... 41
Graham, A. K.
Plating—Yesterday, Today and Tomorrow ... 150
Gray Jr, R. M.
Filtration Of Electroplating Solutions ... 1165
Growth and Perfection of Crystals, R. H. Doremus, B. W. Roberts and D. Turnbull (Books) ... 456
Growth of Chromium Coatings from Liquid Metalic Solutions, S. T. Wlodek and J. Wulff (Books) ... 1029
Grunwald, J. J. and H. B. Linford
Cleaning and Preparation of Metals Prior to Electroplating XII. Effect of Fatty Acid Film—AES Research Project No. 12 ... 1039
Gutzeit, G.
Outline Of The Chemistry Involved In The Process of Catalytic Nickel Deposition From Aqueous Solution—First Part ... 1158
Second Part ... 1275
Third Part ... 1377

Page

H

Hafer, R. F.
American Society For Testing Materials—Committee B-7—Report Of 1958 Activities ... 838
Handling Waste Sludges, J. F. Zievers and C. W. Riley ... 924
Hanson, N. H. and W. Zabban
Design and Operation Problems of a Continuous Automatic Plating Waste Treatment Plant ... 909
Harr, R. E.
Cooperation (Editorial) ... 331
Head, H. E.
Do It Now (Editorial) ... 1229
Head, H. E.
Golden Jubilee: Beacon Pointing AES's Road Ahead (Editorial) ... 555
Heat Sinks For Missile Nose Cones, Copper Electroforming Of, F. D. Foley ... 1268
Heiser, F. A. and J. E. Hyde
Lead Plating of Chrome Plating Anodes ... 385
Heizmann, J. R.
Check Sheet For Motion Analysis, Using M-T-M Symbols ... 1172
Hoffman, F. M.
AES Ladies and the Golden Jubilee Convention ... 949
Horvick, E. W.
Zinc in the World of Electroplating ... 639
Howard, A. M. and L. R. Rogers
The Electroplating of Tin Alloy Solderable Coatings on Ferrous and Non-Ferrous Basis Metals ... 484
How Six AES Branches Conduct their Plating Courses ... 494
How Versatile Application Techniques For Gold Solve Aircraft and Missile Problems, W. L. Aves, Jr. ... 1260
Hull Cell, Modified, J. P. Branciaroli ... 257
Hyde, J. E. and F. A. Heiser
Lead Plating of Chrome Plating Anodes ... 385
Hydrogen Embrittlement of Plated Steel Springs, J. A. Gurklis, L. D. McGraw and C. L. Faust (Books) ... 1029
Hypothetical Day, A (Editorial) ... 107

I

Industrial Finishing Exposition Exhibitors ... 170, 509, 702
Influence of Cathode Film Thickness on Leveling, S. E. Beacom ... 814
Influence of Gas Bubbles on the Formation of Pores—Nature, Cause and Effect of the Porosity in Electrodeposits, F. Ogburn and D. W. Ernst—AES Research Project No. 13 ... 957
International Conference Program ... 282, 399, 501, 693
International Exchange, W. A. Wesley (Editorial) ... 443
Introduction to Fundamental Research on the Mechanism of the Electrodeposition of Metals, An, B. E. Conway and J.O'M. Bockris, AES Research Project No. 16 ... 371

K

Kanning, E. W.
Modern Organic Coatings ... 253

L

Lamb, V. A. and J. P. Young
Production of Embossing Plates from Texture Patterns by Electroforming Methods ... 1033
Lead Anodes For Chromium Plating, H. R. Friedberg ... 834
Lead Plating of Chrome Plating Anodes, F. A. Heiser and J. E. Hyde ... 385
Leveling, The Influence of Cathode Film Thickness on, S. E. Beacom ... 814
Linford, H. B. and J. J. Grunwald
Cleaning and Preparation of Metals Prior to Electroplating XII. Effect of Fatty Acid Film—AES Research Project No. 12 ... 1039
Literature Review on the Use of Molybdenum as an Alloy in Electrodeposits, A, H. W. Schultze and Janet Z. Briggs ... 1370
Los Angeles Convention ... 1283, 1284
Lost Opportunity, C. G. Borlet (Editorial) ... 887
Lubrication of Titanium, N. Fatica (Books) ... 456

M

MacIntosh, R. M.
Tin in Electroplating ... 617
Maines, L. D.
Plastisols and Organosols—Metal Coatings Supreme ... 235
Marotta, G. J.
Automatic Flat Basket Plating ... 1359
Maynes, M. M.
Barrel Finishing for Plating ... 36
Measurement of Plating Thickness, Continuous X-Ray, P. S. Goodwin and C. L. Winchester ... 41
Mechanical Finishing Using Flowing Abrasive Media, C. H. Castle ... 31
Mechanical Finishing
Abrasive Belt Performance Influenced by Several Factors, R. W. Reed ... 27

Page

Barrel Finishing for Plating, M. M. Maynes ... 36
Mechanical Finishing Using Flowing Abrasive Media, C. H. Castle ... 31
Meet Mr. President, Bigge, D. M. ... 496
Membership Drives: Boon or Bane?, M. Ben (Editorial) ... 1003
Metallurgy in Flat Polishing, A. Zimmerman ... 34
Method For Determining Abrasion Resistance Of Thick Anodic Coatings On Aluminum, A, B. E. Deal ... 823
Microscopic Detection Of Porosity, III.—Nature, Cause And Effect Of The Porosity In Electrodeposits, The, F. Ogburn and D. W. Ernst—AES Research Project No. 13 ... 831
Milestone of AES, W. Blum ... 363
Milestones of AES, J. P. Nichols ... 50, 162, 269
Modern Organic Coatings, E. W. Kanning ... 253
Modified Hull Cell, J. P. Branciaroli ... 257
Molybdenum as an Alloy in Electrodeposits, A Literature Review on the Use of, H. W. Schultze and Janet Z. Briggs ... 1370
Motion Analysis Using M-T-M Symbols, Check Sheet For, J. R. Heizmann ... 1172
Murphy, E. B.
Electroplated Electrical Connections And Improved Through Hole Printed Wiring ... 828

N

Nature, Cause And Effect Of The Porosity In Electrodeposits, III. Microscopic Detection Of Porosity, The, F Ogburn and D. W. Ernst—AES Research No. 13 ... 831
Nature, Cause and Effect of the Porosity in Electrodeposits, IV. Influence of Gas Bubbles on the Formation of Pores, F. Ogburn and D. W. Ernst—AES Research Project No. 13 ... 957
Nature, Cause and Effect of the Porosity in Electrodeposits, V. An Evaluation of the Sensitivity of the Ferroxyl Test, F. Ogburn, D. W. Ernst and W. H. Roberts—AES Research Project No. 13 ... 1053
New Economic Method of Treatment of Stainless Steels Prior to Cadmium Plating from Conventional Cyanide Solutions, L. Domnikov ... 481
Nichols, J. P.
Milestones of AES ... 50, 162, 269
Pause To Refresh, A (Editorial) ... 1333
Nickel Deposition From Aqueous Solution, An Outline Of The Chemistry Involved In The Process Of Catalytic G. Gutzeit, First Part ... 1158
Second Part ... 1275
Third Part ... 1377
Nickel
Nickel Plating Baths, Automatic Additions of All Chemicals to the, M. G. Osman ... 819
Nickel Plating, Decorative High Chloride, M. Tippman ... 1054
Nickel Plating, Story of, G. Dubpernell 599
Outline Of The Chemistry Involved In The Process Of Catalytic Nickel Deposition From Aqueous Solution, An—G. Gutzeit
First Part ... 1158
Second Part ... 1275
Third Part ... 1377
Niedhammer, H. A.
Spray Painting with Emphasis on Automation, Hot Spraying and Catalyst Spraying ... 247
Notes on Analysis of Sulfate in Chromium Plating Baths, J. Ducey and G. McKinley 384

O

Ogburn, F. and D. W. Ernst
Nature, Cause And Effect Of The Porosity In Electrodeposits, III. Microscopic Detection Of Porosity—AES Research Project No. 13 ... 831
Nature, Cause and Effect of the Porosity in Electrodeposits, IV. Influence of Gas Bubbles on the Formation of Pores—AES Research Project No. 13 ... 957
Ogburn, F., D. W. Ernst and W. H. Roberts
Nature, Cause and Effect of the Porosity in Electrodeposits, V. An Evaluation of the Sensitivity of the Ferroxyl Test, AES Research Project No. 13 ... 1052
Optimized Metal Finishing Recover System, W. F. Swanton ... 919
Organic Coatings, Modern, E. W. Kanning 253
Organic Finishing
Full Body Dip System at American Motors, The, V. W. Westfall ... 241
Modern Organic Coatings, E. W. Kanning ... 253
Organic Coatings to Chromium Plated Surfaces, Summary of Observations of Factors Influencing Adhesion of—ASTM Committee B-8 Report ... 261
Organic Finishing—Review and Preview, R. D. Wysong (Editorial) ... 211
Plastisols and ,Organosols—Metal Coatings Supreme, L. D. Maines ... 235
Spray Painting with Emphasis on Automation, Hot Spraying and Catalyst Spraying, H. A. Niedhammer ... 247
Summary of Observations of Factors Influencing Adhesion of Organic Coatings to Chromium Plated Surface—ASTM Committee B-8 Report ... 261

Page

Osman, M. G.
Automatic Additions of all Chemicals to the Nickel Plating Baths ... 819
Outline Of The Chemistry Involved In The Process Of Catalytic Nickel Deposition From Aqueous Solution, An, G. Gutzeit
First Part ... 1158
Second Part ... 1275
Third Part ... 1377

P

Parker, E. A.
Precious Metals ... 621
Passal, F.
Copper Plating During the Last Fifty Years ... 628
Pause To Refresh, A, J. P. Nichols (Editorial) ... 1333
Plastisols and Organosols—Metal Coatings Supreme, L. D. Maines ... 235
Plated Hot Work Tool Steels, Fatigue Studies Of, G. W. Lawless, V. F. Lardenoit and B. Cohen ... 1264
Plating—Yesterday, Today and Tomorrow, A. K. Graham ... 150
Plating
Automatic Additions of All Chemicals to the Nickel Plating Baths, M. G. Osman 819
Automatic Flat Basket Plating, G. J. Marotta ... 1359
Copper Plating During the Last Fifty Years, F. Passal ... 628
Decorative High Chloride Nickel Plating, M. Tippman ... 1054
Electroplating of Tin Alloy Solderable Coatings on Ferrous and Non-Ferrous Basis Metals, A. M. Howard and L. R. Rogers ... 484
Lead Anodes For Chromium Plating, H. R. Friedberg ... 834
Plating, Barrel Finishing for, M. M. Maynes ... 36
Plating—Yesterday, Today and Tomorrow, A. K. Graham ... 150
Precious Metals, E. A. Parker ... 621
Progress on Alloy Plating: 1. Tungsten and Molybdenum Alloys, W. H. Safranek and L. E. Vaaler ... 133
Story of Nickel Plating, The, G. Dubpernell ... 599
Tin in Electroplating, R. M. MacIntosh ... 617
Zinc in the World of Electroplating, E. W. Horvick ... 639
Polishing
Finishing Satin Chrome Built-In Ovens, S. J. Beyer ... 463
Polishing, Metallurgy in Flat, A. Zimmerman ... 34
Poor, J. G. and H. Chessin
Evaluation of Adhesion of Thick Electrodeposits ... 1037
Porosity In Electrodeposits, The Nature, Cause And Effect Of The III. Microscopic Detection Of Porosity, F. Ogburn and D. W. Ernst—AES Research Project No. 13 ... 831
Porosity in Electrodeposits, The Nature, Case and Effect of the, IV. Influence of Gas Bubbles on the Formation of Pores, F. Ogburn and D. W. Ernst—AES Research Project No. 13 ... 957
Porosity in Electrodeposits, The Nature, Cause and Effect of, V. An Evaluation of the Sensitivity of the Ferroxyl Test, F. Ogburn, D. W. Ernst and W. H. Roberts—AES Research Project No. 13 ... 1052
Precious Metals, E. A. Parker ... 621
Production of Embossing Plates from Texture Patterns by Electroforming Methods, J. P. Young and V. A. Lamb ... 1033
Progress in the Development of a Nonembrittling Cadmium Electroplating Solution, P. N. Vlannes, S. W. Strauss and B. F. Brown ... 467
Progress on Alloy Plating: 1. Tungsten and Molybdenum Alloys, W. H. Safranek and L. E. Vaaler ... 133
Progress Toward the Development of a Nonembrittling Cadmium Electroplating Process II. Use of Aliphatic Amino Acids as Complexing Agents in Aqueous Baths, P. N. Vlannes and S. W. Strauss ... 1046
Progress Toward The Development Of A Nonembrittling Cadmium Electroplating Process III. The Use of Triethanolamine In Cadmium Plating Solutions, P. N. Vlannes, S. W. Strauss and B. F. Brown ... 1153

R

Recovery System, Optimized Metal Finishing, W. F. Swanton ... 919
Rectifier Output, AC Ripple In, F. A. Schneiders ... 1279
Reed, R. W.
Abrasive Belt Performance Influenced by Several Factors ... 27
Research for Coatings for Protection of Niobium Against Oxidation at Elevated Temperature, E. C. Hirakis (Books) ... 1209
Riley, C. W. and J. F. Zievers
Handling Waste Sludges ... 924
Roberts, W. H., F. Ogburn and D. W. Ernst
Nature, Cause and Effect of the Porosity in Electrodeposits V. An Evaluation of the Sensitivity of the Ferroxyl Test, AES Research Project No. 13 ... 1052

Page

Rogers, L. R. and A. M. Howard
Electroplating of Tin Alloy Solderable Coatings on Ferrous and Non-Ferrous Basis Metals ... 484
Rosenberger, H. M. and C. J. Shoemaker
Critical Examination of the Ferrocyanide Determination of Cadmium and Related References, A ... 1151
Rowan, W. H. and E. J. Seyb
Thicker Decorative Chromium for Better Corrosion Resistance ... 144

S

Safranek, W. H. and L. E. Vaaler
Progress on Alloy Plating: 1. Tungsten and Molybdenum Alloys ... 133
Saubestre, E. B.
Semi-Annual Meeting, Committee B-8, American Society for Testing Materials ... 488, 1378
Schneiders, F. A.
AC Ripple In Rectifier Output ... 1279
Schultze, H. W. and Janet Z. Briggs
Literature Review on the Use of Molybdenum as an Alloy in Electrodeposits, A ... 1370
Seyb, E. J. and W. H. Rowan
Thicker Decorative Chromium for Better Corrosion Resistance ... 144
Shoemaker, C. J. and H. M. Rosenberger
Critical Examination of the Ferrocyanide Determination of Cadmium and Related References, A ... 1151
Some Engineering Aspects of a Good Filtration System, C. G. Borlet ... 932
Spraul, J. R.
Corrosion Data for Chemical Nickel ... 1364
Spray Painting with Emphasis on Automation, Hot Spraying and Catalyst Spraying, H. A. Niedhammer ... 247
Steel, the Corrosion Resistance of And an Evaluating Method for Various Electrodeposits on, H. W. Dettner ... 469
Story of Nickel Plating, The, G. Dubpernell 599
Strauss, S. W., P. N. Vlannes and B. F. Brown
Progress in the Development of a Nonembrittling Cadmium Electroplating Process ... 467
Strauss, S. W. and P. N. Vlannes
Progress Toward the Development of a Nonembrittling Cadmium Electroplating Process II. Use of Aliphatic Amino Acids as Complexing Agents in Aqueous Baths ... 1046
Strauss, S. W., P. N. Vlannes and B. F. Brown
Progress Toward The Development Of A Nonembrittling Cadmium Electroplating Process III. The Use of Triethanolamine In Cadmium Plating Solutions ... 1153
Summary of Observations of Factors Influencing Adhesion of Organic Coatings to Chromium Plated Surfaces—ASTM Committee B-8 Report ... 261
Swanton, W. F.
Optimized Metal Finishing Recovery System ... 919

T

Thicker Decorative Chromium for Better Corrosion Resistance, E. J. Seyb and W. H. Rowan ... 144
Tin in Electroplating, R. M. MacIntosh ... 617
Tippman, M.
Decorative High Chloride Nickel Plating 1054
Trouble-Shooting in the Plating Room ... 45
Tungsten and Molybdenum Alloys, Progress on Alloy Plating, W. H. Safranek and L. E. Vaaler ... 133

U

Use of Aliphatic Amino Acids as Complexing Agents in Aqueous Baths—Progress Toward the Development of a Nonembrittling Cadmium Electroplating Process, P. N. Vlannes and S. W. Strauss ... 1046
Use of Triethanolamine In Cadmium Plating Solutions, The, III—Progress Toward The Development Of A Nonembrittling Cadmium Electroplating Process, P. N. Vlannes, S. W. Strauss and B. F. Brown ... 1153

V

Vaaler, L. E. and W. H. Safranek
Progress on Alloy Plating: 1. Tungsten and Molybdenum Alloys ... 133
Versatile Application Techniques For Gold Solve Aircraft and Missile Problems, How, W. L. Aves Jr. ... 1260
Vlannes, P. N., S. W. Strauss and B. F. Brown
Progress in the Development of a Nonembrittling Cadmium Electroplating Process ... 467
Vlannes, P. N. and S. W. Strauss
Progress Toward the Development of a Nonembrittling Cadmium Electroplating Process II. Use of Aliphatic Amino Acids as Complexing Agents in Aqueous Baths ... 1049

Page

Vlannes, P. N., S. W. Strauss and B. F. Brown
Progress Toward The Development Of A Nonembrittling Cadmium Electroplating Process III. The Use of Triethanolamine In Cadmium Plating Solutions... 1153

W

Waste Treatment
Alkaline Chlorination of Cyanide Wastes and Reduction of Chromium Wastes with Sulfur Dioxide, J. L. Beals... 922
Bibliography of Metal Finishing Wastes, 1958, D. G. Foulke... 934
Design and Operation Problems of a Continuous Automatic Plating Waste Treatment Plant, N. H. Hanson and W. Zabban... 909
Disposal of Plating Room Wastes, R. V. Day... 929
Handling Waste Sludges, J. F. Zievers and C. W. Riley... 924
Optimized Metal Finishing Recover System, W. F. Swanton... 919
Waste Treatment Plant, Design and Operation Problems of a Continuous Automatic Plating, N. H. Hanson and W. Zabban... 909
Wesley, W. A.
Formula For Success (Editorial)... 1125
International Exchange (Editorial)... 443
Westfall, V. W.
Full Body Dip System at American Motors, The... 241
Winchester, C. L. and P. S. Goodwin
Continuous X-Ray Measurement of Plating Thickness... 41
Wysong, R. D.
After the Golden Jubilee—What? (Editorial)... 793
Organic Finishing—Review and Preview (Editorial)... 211

X

X-Ray Measurement of Plating Thickness, Continuous, P. S. Goodwin and C. L. Winchester... 41

Y

Young, J. P. and V. A. Lamb
Production of Embossing Plates from Texture Patterns by Electroforming Methods... 1033

Z

Zabban, W. and N. H. Hanson
Design and Operation Problems of a Continuous Automatic Plating Waste Treatment Plant... 909
Zievers, J. F. and C. W. Riley
Handling Waste Sludges... 924
Zimmerman, A.
Metallurgy in Flat Polishing... 34
Zinc in the World of Electroplating, E. W. Horvick... 639

ARTICLE REFERENCES

Adhesives
Pick Thermosetting Adhesives For Strongest Bonds... 520
Tailor Your Methods To The Job... 520
Thermoplastics: Lowest Cost For Milder Service... 520
Thermosetting-Thermoplastics Fill the Middle Range... 520
Alloys
Changes in the Dimensions Of Aluminium Alloy Articles During Anodic Oxidation, A. V. Shreider... 414
Deposition Of New Chromium-Iron Alloy Plate Of Banded Structure, L. D. McGraw, J. A. Gurklis, C. L. Faust and J. E. Bride... 742
Electrodeposition of Copper-Zinc Alloys from The Pyrophosphate Bath, V. Seee and T. L. Rama Char... 1354
Electrodeposition Of Gold-Copper Alloys, B. S. Krasikov... 21
Electrolytic Deposition Of A Tin-Nickel Alloy From Chloride-Fluoride Solutions, K. M. Tyutina and N. T. Kudryavtsev... 21
Electrolytic Production of Alloys of Nickel With Molybdenum and Tungsten T. F. Frantsevich-Zabludovskaya, A. I. Zayats and K. D. Modylevskaya... 857
Investigation of Cathodic Polarization In Electrodeposition Of Nickel-Tungsten Alloys, T. F. Frantsevich-Zabludovskaya and A. I. Zayats... 21
Some Properties and Applications of Chemically Reduced Nickel, A. McL. Aitken... 300
Aluminum
Anodic Behavior of Aluminum at Low Potentials, J. V. Petrocelli... 1092
Architectural Anodizing... 300
Electroclad Aluminum On Uranium, J. G. Beach and C. L. Faust... 1142
Four Steps To Successful Anodizing, J. B. Kerr... 300
Studies of the Structure of Anodic Oxide Films on Aluminum A, D. J. Stirland and R. W. Bicknell... 978
Vacuum Deposit Aluminum Film... 856
Analysis
The Determination Of Lead In Plating Electrolytes Using Ethylenediamine Tetra-Acetic Acid (Di-Sodium-Salt) and Xylenol Orange Indicator, K. E. Langford... 742
Finishing Pointers—Sampling A Plating Solution, J. B. Mohler... 21
Iron Analysis In Chromium Solutions, A. Salka... 173
A New Approach To The Analysis Of Brass Cadmium and Zinc Plating Solutions Using Ethylene-Diamine Tetra-Acetic Acid And Fast Sulphon Black F., K. E. Langford... 300
Plating Tests For Solution Control, J. B. Mohler... 742
Rapid Determination of Copper and Zinc in Brass Solutions, R. C. Armet... 520
Sulfate Determination In Chromium Plating Solutions Volumetric Method Using E.D.T.A., S. Konishi... 414
Anodizing
Anodizing Observations on Some Recent Improvements, F. Flusin... 301
Equipment Requirements For Anodizing Operations, G. Tramer... 1302
Light-Fastness of Organic Dyes On Anodized Aluminum, R. C. Spooner... 21
Local Anodizing of Aluminium Alloys, V. G. Kononenko and D. A. Lyukevich... 857
Point Anodizing Of Aluminum Alloys (Russian), V. G. Kononenko and D. A. Lyukevich... 21
Present Status Of Aluminum Bright Anodizing (German), R. Lattey... 21
Sealing Anodic Oxide Coatings, S. Wernick and R. Pinner... 1354
Black Nickel
The Mechanism Of the Action Of Organic Brightening Agents in Electroplating Processes, T. C. Franklin, J. Goodwyn, and E. Alexander... 21
Black Oxide Coating
A Black Oxide Finish On Steel, K. C. Srivastava... 1302
Bright Dipping
Bulk Bright Dipping, J. C. Brown... 1302
Cadmium
Cadmium Plating High Strength Alloy Steels. Elimination of Hydrogen Embrittlement, E. Calderon... 1354
Chemical Milling
Chemical Milling, J. L. Gault, C. C. Shepherd, and H. H. Muller... 1354
Chromium
Concentration Changes in the Near-electrode Layers of Chromium Plating Baths and the Mechanism of Chromium Electrodeposition, A. I. Levin and A. I. Falichewa... 856
Crack-Free and Duplex Chromium-Answers to Better Corrosion Resistance, D. E. Weimer... 1354
Duplex Chromium: Thicker, More Corrosion-Resistant Chromium Plate, E. J. Seyb Jr.... 1092
Electrodeposition Of Chromium Alloys, C. Levy... 1142
Electrodeposition Of High-Purity Chromium, F. E. Block, P. C. Good and G. Asai... 300
Reconditioning of Cylinder Liners by Prous Chromium Plating, V. V. Efremov and V. A. Zhikh... 857
The Source of the Nitrogen Impurity in Electrodeposited Chromium, N. Ryan and F. J. Lumley... 856
Studies On Electrodeposited Chromium. II. On The Amount of Ununiformity of Hardness, N. Awa and O. Fusida... 301
Cleaning
Cleaning Hypodermic Syringes H. M. Beal and D. M. Skauen... 1354
Cleaning Prior to Electroplating... 742
Evaluating the Effectiveness of Ultrasonic Cleaning... 856
How To Clean Electrotypes before Chromium Plating, T. E. Wiemeyer... 742
Magnetostrictive Transducer Doubles Ultrasonic Efficiency... 21
The Not-So-Ideal Cleaning Cycle, Dr. S. Spring... 1354
Sonics Cleans Delicate Parts... 300
Ultrasonic Cleaning in Practice, W. Surden... 1354
An Ultrasonic System for Eliminating Physical Contaminants from Electron Devices, D. E. Koontz and I. Amron... 1354
Coating
New Protective Silicate Coating for Metals, O. Loebich... 743
Vacuum Deposited Coatings Today... 173
Control
Analysis Of Sulfuric Anodizing Solutions, J. B. Mohler... 1142
The Analytical Control of The Erftwerk Chemical Polishing Solution for Aluminum, B. A. Scott... 1354
The Chemical Control of Plating Electrolytes, K. E. Langford... 978
Control of Electrodeposition Processes by Examination of the Deposits, T. E. Such... 978
Control of Electrodeposition Processes by Examination of the Deposits, T. E. Such... 1092
Construction and use of the Brenner and Senderoff Contractometer for the Measurement of Stress in Electrodeposits, H. Fry and F. G. Morris... 978
Gage Blocks: Industry's Links To Precision, R. L. McKee... 1302
The How And Why Of Gaging, R. L. McKee... 1302
The How and Why of Gaging, "Mikes"; Fixed Gages; Dial and Air Gaging, R. L. McKee... 1354
Metallic Finishes for Services' Equipment, D. W. Smith... 1354
A Test for the Degree of Sealing of Anodic Coatings on Aluminium, D. E. Bury and H. P. Godard... 978
Trouble-Shooting In The Plating Shop, C. F. Corfe... 1302
Copper
Bright-Copper Plating From A Cyanide Bath In The Presence of Potassium Tartrate. Relation Between Bath Composition Brightness and Leveling T. Ito... 414
Bright Copper Plating of Shaped Articles in Acid Electrolytes, B. P. Persiantseva, N. T. Kudryavtsev and V. M. Kalb... 856
Copper Plating From an Ammoniacal Electrolyte for Local Protection of Steel Articles During Cementation, N. A. Marchenko... 857
Role of Thiourea in the Electrodeposition of Copper, B. Ke, J. J. Hoekstra, B. C. Sison Jr. and D. Trivich... 856
Science for Electroplaters. 49. Copper Plating, L. Serota... 1092
Corrosion
Accelerated Corrosion Tests on Chemically Passivated Electrolytic Zinc Coatings on Steel, T. Biestek... 301
Automotive Trim: Performance and Testing, H. A. Kahler... 742
Buffalo Leads In Rust-Loss. Survey Shows Western N. Y. Area As One Of Nations Worst Rust-Loss Area... 21
Cathodic Protection of Steel in Salt Water... 1354
Chromium Plating In Relation to the Corrosion Resistance of Nickel-Chromium Deposits, A. Smart... 414
Coatings Versus Corrosion... 173
Copper-Nickel-Chromium and Corrosion Protection, A. H. Du Rose and W. J. Pierce... 520
Corrosion Cracking of Brass under the Action of Cyanide Electrolyte, A. V. Shreider... 857
Corrosion Experiences with Dissimilar Metals, A. A. Brouwer... 857
Corrosion Of Aluminum By Alkaline Sequestering Solutions, H. W. Mc Cune... 301
Corrosion Properties Of Tantalum, Columbium, Molybdenum and Tungsten, C. A. Humpel... 173
A Critical Analysis of Pitting Corrosion N. D. Greene and M. G. Fontana... 520
The Deterioration Of Anodized Aluminium Exposed To Corrosive Environment, J. M. Kape... 520
Determining Corrosion Aggressiveness of the Atmosphere, N. D. Tomashov, G. K. Berukshits and A. A. Lokotiloy... 300
Effect of Increasing The Area Of Iron To Zinc On The Rate Of Reversal Of Potential In A Zinc-Iron System, H. J. Shuldener and L. Lehrman... 173
An Electrochemical Study Of Pitting Corrosion In Stainless Steels, N. D. Greene and M. G. Fontana... 520
The Flade Potential Of Iron Passivated By Various Inorganic Corrosion Inhibitors, H. H. Uhlig and P. F. King... 300
Galvanic Corrosion. Effect of pH And Dissolved Oxygen Concentration On The Aluminum Steel Couple, M. J. Pryor and D. S. Keir... 21

Art. Ref. (Continued) — Page

General and Integranular Corrosion of Austenitic Stainless Steels in Acids, M. A. Streicher — 520
The Mechanism Of Passivating-Type Inhibitors, M. Stern — 21
Packaging Today-Protection by Humidity Control — 1354
Potential Studies on Passivity to Corrosion Induced by Pretreatment Processes. II. Comparative Study of Chromate Treatment and Chromate Inhibition — 1092
Resistance Of Cobalt To Certain Solutions, R. S. Young — 742
Screening Tests Of Inhibitors To Prevent Chloride Stress Corrosion, J. H. Phillips and W. J. Singley — 1302
Some Observations On The Mechanism Of Inhibition, A. C. Makrides — 300

Education
Finishing Pointers: Puting Time Determinations, E. F. Duffek — 1354
Science for Electroplaters 48. Electrodeposited Metals, L. Serota — 978
Training Courses in Finishing — 1354

Electroforming
Electroforming Waveguides, J. R. Balmer and T. W. A. Bailey — 1092
Electroforming With Plating Cells, E. B. Saubestre — 25

Electroless Nickel
Electroless Nickel Plating of Carbon, H. J. West — 414
Investigation of pH Behaviour (and Deposition Rate) in the Electroless Nickel Bath, L. Bosdorf and K. Muller — 857

Electroplating
Cathode Potentials During the Electrodeposition of Molybdenum Alloys From Aqueous Solutions, D. W. Ernst and M. L. Holt — 25
Chromium-Nickel Plate Guards Molybdenum — 300
Composition and Application of Anodes, D. J. Fishlock — 414
Composition and Application Of Anodes Part II., D. J. Fishlock — 520
Concentration Displacement in (Silver) Plating Baths, A. V. Krussanstjern and H. Schlegel — 978
A Conference on Current Distribution During Electrodeposition of Metals, L. I. Kadaner — 415
Determination Of Crystal Orientation By High Intensity Reflectograms, G. H. Schwuttke — 742
Effect Of Biologically Polluted Waters In Electrodeposition, K. Sommer — 742
The Electrochemistry of Nickel. I. Codeposition of Nickel And Hydrogen From Simple Aqueous Solutions, J. Yeager, J. P. Cels, E. Yeager and F. Hovorka — 742
Electrodeposition of Gold Copper Alloys, B. S. Krasikov — 857
Electrodeposition of Metals from Aqueous Fluoride Solutions, A. N. Kappanna and E. R. Talaty — 1354
Electrodeposition Of Molybdenum, T. T. Campbell — 414
Electroplating and Electrorefining Of Metals from the Sulphamate Bath, T. L. Rama Char — 25
Electroplating and Metal Preservation Studies Utilizing Radio-Isotopes, S. L. Eisler — 414
Electroplating on Certain Transition Metals, E. B. Saubestre — 742
Electroplating on Light Metals, D. S. Tandon and T. Banerjee — 1354
Electroplating on Thorium, J. G. Beach and G. R. Schaer — 856
Electroplating On Titanium, N. Murphy — 1142
A Flame Spectrophotometric Method For the Determination Of Nickel and Boron In Plating Solutions, D. E. Fornwalt — 414
Guide Lamp's New Approach to Plating Automotive Die Castings, G. H. Poll, Jr. — 978
Influence of Microrelief on the Current Distribution on Electrodes, L. I. Kadaner — 414
Mechanism of Electrodeposition of Nickel From Liquid Ammonia Solutions of Spin-Free Nickel (II) Complexes, G. W. Watt and D. A. Hazlehurst — 414
A Missile-Makers Titanium Plating Process, C. W. Handova — 414
New Process For Plating On Light Metals, J. V. Sheridan — 25
Nickel Plating with Periodic Reverse Current, N. I. Zhinovich, M. M. Menkina and K. F. Rubenchik — 857
A Radioisotopic Study Of Leveling In Bright Nickel Electroplating Baths, S. E. Beacom and B. J. Riley — 742
Replacement of Boric Acid in Nickel Plating, M. E. Goldshtein and B. E. Kozduner — 857
Zinc Plating in a Cyanide Electrolyte and the Mechanical Properties of the Steels, I. I. Moroz and N. T. Kudryavtsev — 414
Zinc Plating of Articles by the Use of Bipolar Electrodes, Y. V. Kuzmin — 978

Electropolishing
Electro-Polishing Aluminum Reflectors, J. Nugent — 25
Influence of Electropolishing on the Corrosion of Aluminum in Dilute Solutions of Nitric Acid, A. Malinowska — 743
State of the Surface and the Anodic Potentials of Copper and Nickel During Electrochemical Polishing, N. P. Fedot'ev and S. Y. Grilikhes — 743

Embrittlement
High-Strength Steel Can Be Cadmium Plated Without Embrittlement, D. J. Cash and W. Scheuerman — 520

Engineering
Aluminum And Copper Busbars In The Plating Shop, D. W. Taylor — 25
Automation Applied To Barrel Cadmium Plating, W. J. Rein — 300
Engineering Uses of Plated Coatings, L. F. Spencer — 856
How To Engineer An Automatic Plating Installation, F. G. Brune — 173
New Portable Precious Metals Solution Filter Claims To Be Leak-Proof — 173
Progress in Rectifiers, K. M. G. Stewart — 414
Rectifiers in the Electroplating Industry G. Schore — 856
Selecting Cleaning And Surface-Preparation Equipment, S. J. Barlett — 25
Van Der Horst Evaluates Titanium Tubing for Heating and Cooling Chrome Solutions — 414
Which Rectifier for Electroplating—Silicon or Germanium, T. J. Cataldo — 414

Equipment
Rectifiers in the Electroplating Industry II. Still Tank Plating, G. Schore — 978

Etching
Current Practice in Chemical Milling, N. W. Berst — 414

Finishing
Abrasive Belts Help Reduce Your Tumbling Time, C. G. Tuvek — 742
Better Buffing Thru Better Buff Design, S. P. Sax — 1092
Buffing At Ford's Monroe Plant, M. M. Patterson — 1142
Finishing Pointers: Plating on Inconel: E. Calderon — 1092
Finishing Zinc Base Die Castings, L. Spencer — 25
Flat Polishing Specialists, E. A. Blount — 856
How To Polish and Buff Aluminum — 520
The Nature Of Mechanically Polished Metal Surfaces, L. E. Samuels — 742
The Nature of Mechanically Polished Metal Surfaces, L. E. Samuels — 978
Polishing and Buffing Of Aluminum, L. J. Benson — 173
The Problem: Finish Printed Circuits — 1142
Surface Finishing Stainless Steels, L. F. Spencer — 1092

Gold
Hard Gold Plating, A. G. Atansyants, N. T. Kudryavtsev and V. M. Karataev — 301
Some Observations on the Tarnishing of Electroplated Gold Thread (Zari), J. Balachandra and A. A. Krshman — 978

Indium
Glycerol Baths For The Electrodeposition Of Molten Indium Or Indium-Cadmium Alloy, A. J. Certa, T. J. Manns, G. L. Schable and H. S. Segal — 1142

Inhibition
Corrosion Inhibitor Testing Inside A Products Pipe Line, R. H. Meyer — 743
The Evaluation Of Certain Organic Nitrogen Compounds As Corrosion Inhibitors, E. J. Schwoegler and L. U. Berman — 743

Instrumentation
Surface-Finish Measurement On Nonferrous Materials, B. Piper and W. P. Callis — 1142

Iron
Electrolytic Iron Powder From A Caustic Soda Solution, J. A. LeDuc and R. E. Loftfield — 1142

Management
Increased Productivity thru Proper Worker Incentives, A. T. Leonard — 856

Mechanical
Controlled Vibrations Speed and Simplify Parts Finishing, W. E. Brandt — 301

Meetings
Institute of Metal Finishing—Highlights of the Annual Conference, Brighton, April 1959 — 978

Metal Spraying
Metal Spraying In Relation To The Corrosion Process, J. R. Franklin — 25
Second International Conference on Metal Spraying (Part 1) — 414

Miscellaneous
The Anodic Oxidation of Zinc and A Method of Altering the Characteristics of the Anodic Films, H. Fry and M. Whitaker — 1092
Anodic Protective Coating On Magnesium. The cr-22 Process—A Depletion Study, R. Wick and M. Reed — 743
Effects of Chloride on the Orientation of Nickel Deposits, B. C. Banerjee and A. Goswami — 1092
Exterior Automotive Trim: Chromium Plate, Stainless or Aluminum, M. Diggin, R. VandenBerg, V. Snodgrass — 1092
Fault-Finding In The Plating Department, P. Green — 301
Finishing Zinc Base Die Castings, L. Spencer — 173
Health Legislation Concerning Paint Ingredients, H. P. Preuss — 1142
Increased Productivity Thru Proper Worker Incentives, A. T. Leonard — 743
Influence of the Method of Anodic Passivation of the Concentration of the Electrolyte on the Porosity of Al0 Films, A. F. Bogoyavlenskiy and N. V. Siletskaya — 414
Influence of the Relative Contents of Sodium Cyanide and Sodium Hydroxide in Zinc Electrolytes On The Mechanical Properties of Steels, I. I. Moroz and N. T. Kudryavtsev — 414
Institute of Metal Finishing Annual Conference—Brighton 1959, R. Pinner — 1092
Inventions and Patents, A. H. Seidel — 520
The Japanese Plating Industry Today — 1142
Know What You're Doing When You Set Up For Chemical Milling, K. Clarke — 301
Metal Cleaning and Finishing Handbook — 978
Modern Management Methods And Their Application To The Smaller Plating Shop, E. A. Ollard — 743
Plating Process Co-Deposits Oxides or Carbides, A. E. Grazen — 414
Reliable Properties Can Be Guaranteed, R. S. Jackson — 301
Science For Electroplaters. Amines, L. Serota — 173
Self-Adhesive Tapes in Metal Finishing — 25
The Supervisor and His Boss, A. M. Cooper — 743
A Vacuum Deposited Coating that Withstands Exterior Exposure — 978

Molybdenum
Molybdenum Plating Inside of Large Bore Tubes, P. L. Raymond — 856

Nickel
Bright Nickel Plating Of Leaded Brasses and Bronzes, Gianluigi Galli — 25
The Effects of Magnesium Salts on Nickel Plating Baths, A. Genezdy, W. A. Kuehler and W. Machu — 856
Effects of Chloride on the Orientation of Nickel Deposits, B. C. Banerjee and A. Goswami — 1092
Effects Of Impurities In A Bright Nickel Bath On The Covering Power Of A Chromium Bath, R. H. Rousselot and G. E. Rousselot — 173
Effects of Impurities In A Bright Nickel Bath On The Covering Power Of A Chromium Bath, R. H. Rousselot and G. E. Rousselot — 301
Electroplating of Nickel from the Pyrophosphate Bath, S. K. Panikkar and T. L. Rama Char — 978
Hard Nickel Plating in Russia—Sulfate Oxoate Bath, A. J. Steiger — 301
Influence of the Conditions of Electrodeposition and Electrolyte Composition on the Porosity of Electrodeposited Nickel Coatings, A. I. Rotinyan, N. P. Fedotev, E. E. Mishachenkova and D. D. kho — 978
Plating Team Holds Down Cost In Tooling For Nose Cones, G. H. Cook and L. P. Vollmuth — 1142
A Radioisotopic Study of Leveling in Bright Nickel Electroplating Baths, S. E. Beacom and B. J. Riley — 856
Relations Between Texture and Properties of Nickel Electrodeposits, G. S. Vozdvizhensky and R. S. Saifullin — 857
Some Developments in Barrel Nickel Plating, B. E. Bunce — 25
The Structure of Electrodeposited Nickel, B. C. Banerjee and A. Goswanni — 301

Organics
Application Techniques, Properties and Chemical Resistance of Polyethylene Coatings — 743
Automation Painting In Russian Machine Tool Manufacturing, A. J. Steiger — 173
Coatings For Vacuum Metallizing On Plastics, M. A. Self and J. Scharnberg — 743
Dip Dyeing of Finishes for Vacuum Metalizing, R. J. Perkel — 978
Editor's Report On 1958 Paint Convention — 25
Epoxy Coating Methods Shown — 25
Evaluation of Protective Coatings for Ship Bottoms, J. R. Brown — 978
Ford's Experiences With Water-Borne Paints, R. D. Hamilton — 1142
How To Specify A Painted Finish, A. E. Heyson — 520
Hybrid Painting Machine Flow Coats, Sprays — 1142
Hyrtatic Stapoadying of Organic Finishes, J. A. Weed — 1092

Art. Ref. (Continued) — Page

Improved Fluorescent Paints Expand Their Engineering Uses, N. I. Gaynes 520
Improved Pearl Essences, W. F. Decker 856
Improving Your Wrinkle Painting, H. D. Kaiser and T. G. O'Brien 173
The Mechanism Of Paint Stripping, S. Spring 743
New Water Soluble Baking Paint Makes Its Debut, D. A. Marino 25
Organic Coatings For Metal Products, R. J. Fabian 743
Organic Protection Schemes for Modern Helicopter, P. W. Hyde 1092
Performance of Organic Coatings in Tropical Environments, A. L. Alexander, B. W. Forgeson and C. R. Southwell 978
Preparation Of Steel Surfaces for Repainting, J. Hurst 25
Quality Control in Paint Finishing, H. Shapiro 856
Science For The Coatings Technologist. Part XII. Paint Additives-Mildewcides, E. S. Beck 301
Science for the Coatings Technologist Part XIII Additives: Stabilizers, E. S. Beck 856
Silicones in Industrial Finishes, R. C. Hedlund 978
Spray Booths In Operation, M. Reeves 25
Testing Finishes For The Future 173

Wash Primer Development and Characteristics, L. R. Whiting 978
Water-Dispersed Paints For Products Finishing, M. C. Carpenter 520

Pickling
Factors Influencing The Rate-Of-Pickling Test On Tinplate Steel, R. M. Hudson and G. L. Stragand 743
Pickling and Acid Dipping of Metals, J. B. Mohler 856
Precautionary Procedures In Chemical Cleaning, R. A. Stander 520

Platinum
Platinum Plating of Zirconium, A. B. Tripler, J. G. Beach and C. L. Faust 978

Rhodium
Testing Of Rhodium Baths By the Hull Method, S. Dorner and L. Froeis 301

Safety
Fire Hazards In Metal Finishing, D. J. Fishlock 743
Play It Safe With Degreasing Operations, H. Allen 173

Stripping
Stripping Metallic Coatings, J. B. Mohler 173

Theoretical
Crystal Growth Of Electrodeposited Zinc. An Electron Diffraction And Electron Microscopic Study, R. Sato 520
Electromotive Force Series Of Metals In Fused Salts And Activities Of Metal Chlorides In 1:1 Molar KCl-NaCl Solutions., S. N. Flengas and T. R. Ingraham 1142

Titanium
Electrodeposition of Adherent Titanium Coatings on Induction Heated Cathodes in Fused Salts, B. J. Fortin, J. G. Wurm, L. Gravel and R. J. A. Potvin 865
Surface Hardening of Titanium by Treatment in Fused Borax, A. N. Minkevich and Yu. N. Shul'ga 415

Waste Disposal
Plating Waste Disposal Incegrated System At Ronson Corp., W. Mikos and A. Szkudlapski 414
Treatment of Effluents In The Metal Finishing Industry, R. Jusath 414, 520
Treatment Of Plating Wastes By Ion Exchange, R. F. Heidorn and H. W. Keller 520
Trends In Waste Disposal, D. Gardner Foulke 25

Waste Treatment
Dialysis For Solution Treatmeat In The Metal Finishing Industry, R. Dvorin 743

Zirconium
Developments in Finishing Zirconium, N. F. Murphy 1092

PATENT ABSTRACTS

Alloys
Mirror Coating Alloys—No. 2,821,089, 4/7/59—W. C. Herrmann 1191
Nickel-Chromium Diffusion Alloy—No. 2,859,158, 11/3/58—G. Schaer 518
Scale Removal from Alloy Steel—No. 2,863,792, 12/9/58—H. Todd 748

Aluminum
Aluminized Magnesium—No. 2,881,514, 4/14/59—F. Drummond 1191
Aluminum Coating—No. 2,855,304, 5/5/59—R. Thompson 1402
Aluminum Conversion Coating—No. 2,868,679, 1/13/59—G. Pimbley 860
Aluminum Deoxidant—No. 2,867,514, 1/6/59—N. Newhard and James Thrisk 754
Aluminum Solder—No. 2,875,514, 3/3/59—R. Doerr 1090
Composition for Treating Aluminum—No. 2,833,311, 4/21/59—D. Halpert 1298

Anodes
Anode Rack—No. 2,856,344, 10/14/58—S. Lapham 408

Anodizing
Anodizing—No. 2,855,350, 10/7/58—R. Ernst 305

Barrels
Barrel Treating—No. 2,849,097 8/26/58—W. Jackson 64
Feed for Plating Barrel—No. 2,868,709, 1/13/59—R. Bikales 861

Brass
Brass Plated Wire—No. 2,870,526, 1/27/59—O. Adler 864

Buffing
Buffing Composition—No. 2,850,369, 9/2/58—W. Riegler and J. Dybalski 65
Buffing Wheel—No. 2,882,654, 4/21/59—S. Mockiewicz and J. Bacha 1298
Buffing Wheel—No. 2,882,653, 4/21/59—J. Wisniewski 1298
Enameling Aluminum—No. 2,858,245, 10/28/58—J. Carrol and J. Thirsh 409
Gas Plating of Aluminum, No. 2,867,546, 1/6/59—W. MacNevin 984
Process of Coating Aluminum Surfaces—No. 2,851,385, 9/9/58—F. Spruance and Nelson Newhard 183
Producing Boehmite Layer on Aluminum Foils—No. 2,859,148, 11/3/58—D. Altenpohl 518
Protective Coating for Aluminum, No. 2,859,144, 11/4/58—B. Jeremais 969
Soldering Aluminum—No. 2,857,321, 10/21/58—J. Williams 409
Zinc-Tin Solder for Aluminum—No. 2,864,733, 12/16/58—F. Kranich 749
Manufacture of Buffing Elements—No. 2,882,139, 4/14/59—A. Rock 1298
Pleated Buffing Wheel—No. 2,867,062, 1/6/59—F. Hendrickson 754

Cadmium
Cadmium Electroplating—No. 2,862,-860, 12/2/58—P. Vlannes 748
Cadmium Plating—No. 2,848,393, 8/19/58—D. Foulke and O. Kardos 63
Displacement of Cadmium on Aluminum—No. 2,850,441, 9/2/58—J. Greene and J. Holzwarth 183

Chromium
Chromate Coating Magnesium—No. 2,861,019, 11/18/58—H. DeLong 518
Chromate-Fluoride Coating Solutions—No. 2,868,682, 1/13/59—G. Dell 860
Chromium Plating—No. 2,855,348, 10/7/58—T. Topelian 305
Chromium Plating—No. 2,856,334, 10/14/58—P. Topelian 408
Composite Chromium Electroplate—No. 2,871,550, 2/3/59—M. Weinberg and H. Brown 984
Electrowinning Chromium—No. 2,872,-395, 2/3/59—M. Carosella 1089
Purifying Chromium Electrowinning Solutions—No. 2,849,354, 8/26/58—M. Carosella 65

Chromizing
Chromizing—No. 2,855,332, 10/7/58—G. Samuel 304
Chromizing Coating—No. 2,885,301, 5/5/59—G. Samuel 1402
Ductile Chromizing—No. 2,851,375, 9/9/58—G. Samuel 183
Improving Physical Properties of Chromized Articles—No. 2,875,112—2/24/59—C. Wilkinson 1090

Cleaning
Cleaning Magnesium—No. 2,849,297, 8/26/58—A. Wisken 64
Cleaning Method and Apparatus—No. 2,852,417, 9/16/58—T. Kearney 184
Degreaser—No. 2,865,145, 12/23/58—I. Lans 749
Degreaser—No. 2,867,225, 1/6/59—E. Zademach, et al. 754

Copper
Autocatalytic Copper Plating—No. 2,-874,072, 2/17/59—A. Cahill and V. McConnell 1089
Bright Copper Plating—No. 2,854,389, 9/30/58—E. Boelter 304
Bright Copper Plating—No. 2,848,394, 8/19/58—D. Foulke and O. Kardos 63
Bright Copper Plating—No. 2,859,159, 11/3/58—C. Wernlund 518
Copper Cyanide Plating—No. 2,862,-861, 12/2/58—P. Moy 748
Copper Electrodeposition—No. 2,873,-234, 2/10/59—F. Passel 1089
Copper Plating—No. 2,882,209, 4/14/59—H. Brown and R. Fellows 1298
Copper Plating—No. 2,881,121, 4/7/59—D. Foulke, O. Kardos and H. Koretzky 1191
Copper Plating—No. 2,861,929, 11/25/58—D. Martin and A. Parker 519
Copper Plating—No. 2,852,450, 9/16/58—E. Mundell 184
Copper Sensitizers—No. 2,872,359, 2/3/59—E. Saubestre 984
Ductile Copper Plates—No. 2,871,173, 1/29/59—E. Castellano 969
Plating Copper-Tin Alloys—No. 2,-854,388, 9/30/58—W. Safranek and C. Faust 304
Plating Copper on Aluminum—No. 2,-871,171, 1/27/59—J. Atkinson 969

Electrodeposition
Electrodeposition Apparatus—No. 2,-861,936, 11/25/58—D. Colasanto 519
Electrodepositing Chromium—No. 2,-852,447, 9/16/58—J. Hausner 184
Electrodepositing Copper—No. 2,876,-178, 3/3/59—E. McCoy 1091
Electrodeposition of Nickel—No. 2,-852,449, 9/16/58—D. Becking and H. Brown 184
Electrodeposition of Nickel—No. 2,-848,392, 8/19/58—H. Ford and W. Shenk 63
Electrodeposition of Nickel on Uranium—No. 2,849,348, 8/26/58—A. Gray 65
Production of Sheet Metal by Electrodeposition—No. 2,865,830, 12/23/58—J. J. Zoldar 749

Electrolytes
Battery Electrolyte—No. 2,872,362, 2/3/59—M. Mendelsohn and C. Horowitz 984
Electrolytic Deposition of Aluminum—No. 2,849,349, 8/26/58—K. Ziegler and H. Lehmkull 65
Electrolytic Dissolution of Stainless Steel—No. 2,865,832, 12/23/58—E. Pitzer 749
Electrolytic Etching—No. 2,861,931, 11/25/58—J. Faust 519
Electrolytic Grinding—No. 2,871,177, 1/27/59—G. Comstock 1188
Electrolytic Polishing—No. 2,861,930, 11/25/58—H. Robinson 519
Electrolytic Process—No. 2,880,149, 3/31/59—S. Carlton and B. Raynes 1191
Electrolytic Process—No. 2,852,452, 9/16/58—G. Cunningham 184
Electrolytic Process—No. 2,880,147, 3/31/59—G. Cunningham 1190
Electrolytic Purification of Water—No. 2,852,455, 9/16/58—J. Hausner 184
Electrolytic Refining of Lead—No. 2,-877,165, 3/10/59—G. Turner 1091
Purification of Electrolytes—No. 2,858,-257, 10/28/58—M. Ceresa 410
Rigidized Electrolytically Formed Metal Sheets—No. 2,878,553, 3/24/59—H. Hirsch 1101
Treatment of Aqueous Alkali Cyanide Electrolytes—No. 2,861,927, 11/25/58—M. Ceresa and J. Crain 519

Electroplating
Chemically Plating Metals—No. 2,873,-214, 2/10/59—G. Schnable 1089
Chemical Nickel and Cobalt Plating Process—No. 2,871,142, 1/27/59—S. Hayes 864
Electroplating—No. 2,849,351, 8/26/58—W. Gundel 65
Electroplating—No. 2,849,352, 8/26/58—A. Krstahler, et al. 65
Electroplating Duplex Nickel—No. 2,-879,211, 3/24/59—O. Kardos and R. Neumann 1190
Electroplating Machine—No. 2,865,831, 12/23/58—N. Ransohoff 749
Electroplating Nickel—No. 2,881,120, 4/7/59—J. Towle and J. Long 1191
Electroplating on Aluminum—No. 2,-879,210, 3/24/59—A. Howard 1188
Electroplating on Al, Zn, Ti and Pb—No. 2,856,333, 10/14/58—O. Topelian 408
Jet Plating—No. 2,854,387, 9/30/58—E. Zimmerman 304
Jet Plating—No. 2,873,232, 2/10/59—E. Zimmerman 1089
Metal Plating Bath—No. 2,872,346, 2/3/59—A. Miller 984
Method of Plating Metal With Magnesium—No. 2,876,137, 3/3/59—F. Drummond 1090
Plating Quartz Crystals—No. 2,856,313, 10/14/58—P. Gerber and W. Schafer 305

Electropolishing
Electropolishing—No. 2,868,705, 1/13/-59—John Bair 861
Electropolishing—No. 2,871,174, 1/29/-59—D. Turner 864
Electropolishing—No. 2,871,175, 1/27/-59—D. Zaremski 1188
Electropolishing Apparatus—No. 2,-853,447, 9/23/58—M. Hackenburg 184
Electropolishing Apparatus—No. 2,-861,937, 11/25/58—J. Jumer 519
Electropolishing Method—No. 2,874,-104, 2/19/59—E. Bowerman and E. Saubestre 1090
Electropolishing of Zirconium—No. 2,-851,406, 9/9/58—E. Bowerman and E. Saubestre 184

(Pat. Abs., Continued) Page

Etching
Apparatus for Selectively Contouring a Metal Part by Etching—No. 2,865,125, 12/23/58—W. Langsfield 749
Etching Aluminum—No. 2,869,267, 1/20/59—E. Holman 861
Etching a Metal Surface—No. 2,869,266, 1/20/59—F. Hindler 861
Etching Machine—No. 2,857,697, 10/28/58—N. Schutt, et al 409
Etching Metals—No. 2,885,273, 5/5/59—P. Degoetz and L. P. Streett 1402

Equipment
Apparatus for Plating Interior Surfaces—No. 2,859,157, 11/3/58—John Curtiss Jr. 518
Article Holder—No. 2,856,345, 10/14/58—J. Pociask 408
Conveyor—No. 2,881,711, 4/14/59—J. Davis and L. Pianowski 1298
Conveyor—No. 2,848,405, 8/19/58—J. and F. Lisowski 64
Lift Arm Assembly—No. 2,860,099, 11/11/58—James Barton 518
Pipe and Conduit Plating Apparatus—No. 2,854,395, 9/30/58—F. Kennedy 304
Plating Machine—No. 2,851,044, 9/9/58—John Daves 183
Plating Rack—No. 2,858,265, 10/28/58—M. Schneider 410
Pointing Wire—No. 2,850,448, 9/2/58—C. Stricker 183
Polishing Apparatus—No. 2,880,554, 4/7/59—L. Simjian 1191
Processing Machine, No. 2,869,560, 1/20/59—V. Finston 984
Processing Machine—No. 2,885,055, 5/5/59—P. Hauck 1402
Printed Wiring Boards—No. 2,872,391—2/3/59—J. Hauser 1089
Pulley for Wire Plating Apparatus—No. 2,882,214, 4/14/59—W. Summers and H. Hasell 1298
Rectifier—No. 2,870,046, 1/20/59—R. Van Asselt and C. Gerdes 861
Transfer Apparatus—No. 2,874,820, 2/24/59—E. Robert 1090

Galvanizing
Hot Dip Galvanizing—No. 2,875,096, 2/24/59—W. Diehl and H. Bell 1090
Rack for Hot Dip Galvanizing—No. 2,852,410, 9/16/58—H. Brewer 184
Treating Galvanized Metal—No. 2,859,146, 11/4/58—A. Prust 518

Gas Plating
Gas Plating, No. 2,859,132, 11/4/58—L. Novak and H. Homer 969
Gas Plating Light Metals—No. 2,880,115, 3/31/59—F. Drummond 1190

Gold
Bright Gold—No. 2,799,633, 12/28/58—E. Rinker 754

Iron
Coated Iron—No. 2,873,215, 2/10/59—F. Quigley and H. Walters 1089

Miscellaneous
Battery Acid—No. 2,861,016, 11/18/58—J. Machool 518
Blocking Layer on Selenium Rectifier, No. 2,872,357, 2/3/59—S. Fry 984
Boride Coatings—No. 2,849,336, 8/26/58—M. Reid and A. Brenner 64
Chem-Milling of Honeycomb Structures—No. 2,849,299, 8/26/58—H. Young 64
Coated Refractory Body—No. 2,857,664, 10/28/58—D. Luks & J. Powell 409
Coating—No. 2,877,145, 3/10/59—C. Baer and P. Clough 1091
Coating and Hardening Steel—No. 2,857,300, 10/21/58—H. Moller 409
Coating Cylinders—No. 2,880,109, 3/31/59—F. Current and G. Mohnkern 1190
Coating Magnesium—No. 2,880,148, 3/31/59—H. Evangelides 1190
Conductive Ink—No. 2,851,380, 9/9/58—W. Berlinghof 183
De-enameling Process—No. 2,870,048, 1/20/59—C. Woerther 864
Deoxidizing Metal—No. 2,878,146, 3/17/59—A. Certa 1101
Deposition of Tungsten Carbides, No. 2,87.,350, 2/3/59—H. Homer and J. Whitacre 984
Electrodializing—No. 2,848,403, 8/19/58—N. Rosenberg 64
Electroformed Screens—No. 2,870,068, 1/20/59—G. Schaer 864
Electroforming System—No. 2,879,209, 3/24/59—S. Failkoff 1188
Electrolysis Process, No. 2,867,569, 1/6/59—R. Kronenthal 984
Electrophoretic Method—No. 2,858,256, 10/28/59—F. Fahnoe and J. Shyne 410
Electrophoretic Method—No. 2,861,935, 11/25/58—F. Fahnoe and James Shyne 519
Electrophoretic Method—No. 2,872,188, 2/3/59—F. Fanoe and J. Shyne 1089
Flame Spraying—No. 2,848,349, 8/19/58—H. Rechter and M. Eisenberg 63
Fluid Electrical Contact—No. 2,867,574, 1/6/59—E. Berry 860
Flux—No. 2,880,125, 3/31/59—E. Jordan and F. Lederer 1190
Flux—No. 2,879,195, 3/24/59—D. Speed and I. Smith 1188
Lamination Construction—No. 2,848,391, 8/19/58—F. Fahnoe and J. Shyne 63
Manufacturing Abrasive Surfaces—No. 2,878,171, 3/17/59—M. Ferrand 1101
Metal Coating—No. 2,860,098, 11/11/58—F. Fahnoe and J. Shyne 518
Metal Coating Compositions—No. 2,885,312, 5/5/59—L. McDonald 1402
Metal Treating—No. 2,871,140, 1/27/59—N. Gross 864
Metal Treatment—No. 2,861,906, 11/25/58—L. Schuster and A. Baldi 518
Method for Improving Electric Storage Batteries—No. 2,857,295, 10/21/58—H. Brown 409
Method of Producing Articles for Enameling, No. 2,872,352, 2/3/59—F. Porter, et al 984
Nitride Coating Process—No. 2,865,971, 12/23/58—W. Ruppert and G. Schwedler 749
Oxalate Coatings—No. 2,863,791, 12/9/58—P. de Cerma 748
Oxalate Coatings—No. 2,850,417, 9/2/58—H. Jenkins and D. Freeman 304
Porcelain Enameling—No. 2,849,344, 8/26/58—M. Cramer 64
Production of Hydrides, No. 2,867,568, 1/6/59—G. Cunningham 984
Production of Metals—No. 2,880,156, 3/31/59—F. Benner and E. Chadsey 1190
Protecting Magnesium—No. 2,864,730, 12/16/58—D. Kinder and R. Stricklin 748
Protective Coating—No. 2,857,292, 10/21/58—D. Moore 408
Protective Films for Metals—No. 2,864,731, 12/16/58—D. Gurinsky, et al 748
Rifling Gun Barrels—No. 2,848,401, 8/19/58—J. Hartley 64
Stripping Metal Coatings, No. 2,872,361, 2/3/59—H. Siefen and J. Campbell 984
Treating Magnesium-Bearing Aluminum—No. 2,885,313, 5/5/59—S. Milliken 1402
Treating Metals with Ferrate Solutions—No. 2,850,415, 9/2/58—J. Rufford 65
Treatment for Magnesium, No. 2,854,371, 9/30/58—S. Schjelderup 969
Treatment of Steel for Enameling—No. 2,862,841, 12/2/58—L. Bernick, et al 748
Treatment to Increase Friction—No. 2,877,716, 3/17/59—J. Ryzner 1101

Molybdenum
Coated Molybdenum Article—No. 2,854,739, 10/7/58—K. Bartlett and P. Turner 304
Coating for Molybdenum—No. 2,878,554, 3/24/59—R. Long 1101
Coating Molybdenum—No. 2,857,297, 10/21/58—J. Moore, et al 409

Nickel
Bright Nickel—No. 2,872,392—2/3/59—B. Martin 1089
Bright Nickel—No. 2,870,069, 1/20/59—B. Ostrow 864
Bright Nickel Plating—No. 2,849,353, 8/26/58—O. Kardos 65
Chemical Nickel Plating, No. 2,872,353, 2/3/59—D. Metheny 984
Chemical Nickel Plating—No. 2,874,063, 2/17/59—D. Metheny and E. Browar 1089
Coating with Nickel—No. 2,881,094, 4/7/59—T. Hoover 1191
Nickel Plating—No. 2,882,208, 4/14/59—H. Brown 1298
Nickel Plating—No. 2,876,177, 3/3/59—Gundel 1091
Nickel Plating—No. 2,884,344, 4/28/59—E. Ramirez 1402
Nickel Plating-Wolfram Carbide—No. 2,885,329, 5/5/59—H. Slatin 1402

Oxidation
Oxidation of Copper—No. 2,878,149, 3/17/59—W. Mason 1101
Presenting Oxidation of Metals—No. 2,856,321, 10/14/58—R. Parson and J. Truckler 305

Oxides
Forming a Dielectric Oxide Film on Metal—No. 2,868,702, 1/13/59—Joseph B. Brennen 861
Removing Oxides from Strip—No. 2,862,839, 12/2/58—E. McHenry 519

Phosphates
Cleaning and Phosphating Metal—No. 2,857,298, 10/21/58—C. Smith 409
Increasing Solubility of Phosphating Accelerators, No. 2,854,369, 9/30/58—M. Kronstein 969
Phosphate Coating—No. 2,877,148, 3/10/59—R. Drysdale and S. Burton 1091
Phosphate Coating, No. 2,854,370, 9/30/58—M. Kronstein 969
Phosphate Coating—No. 2,856,322, 10/14/58—R. Parson and J. Truckler 408
Phosphate Coating—No. 2,882,189, 4/14/59—W. Russell and R. Gibson 1298
Phosphate Coatings on Drawn Wire—No. 2,875,111—2/24/59—C. Wilkinson 1090
Phosphating Bath—No. 2,863,793, 12/9/58—P. de Cerma 748
Phosphating Pretreatment—No. 2,874,081, 2/17/59—W. Cavanagh and J. Maurer 1090
Phosphating Solution, No. 2,854,368, 9/30/58—L. Shrier 969
Phosphating Treatment, No. 2,854,367, 9/20/58—B. Tuttle, et al 969

Pickling
Electropickling—No. 2,860,092, 11/11/58—A. Hart and G. Kamm 518
Nitric Acid Pickling—No. 2,848,351, 8/19/58—E. Boller, et al 63
Pickling and Coating Stainless Steel—No. 2,868,680—1/13/59—J. Hendricks 860
Pickling Solutions—No. 2,876,144, 3/3/59—H. Bomberg and M. Vordahl 1091
Reclaiming Pickle Liquor—No. 2,865,823, 12/23/58—A. Harris and C. Strickler 749

Printed Circuits
Printed Circuits—No. 2,861,029, 11/18/58—L. Bain and R. Geshner 518
Printed Circuits—No. 2,848,359, 8/19/58—P. Talmey 63

Rhodium
Plating Rhodium—No. 2,866,740, 12/30/58—F. Reid 754

Silver
Passivating Silver—No. 2,850,419, 9/2/58—J. Melse and P. Baeyens 183
Silvering Non-Metals—No. 2,879,175, 3/24/59—E. Umblia and E. Shulze 1101
Silvering Process—No. 2,871,139, 1/27/59—S. Wein 864
Silver Lined Steel Structure—No. 2,856,682, 10/21/58—J. Chyle 406
Silver Plating Stainless Steel Ware—No. 2,878,172, 3/17/59—A. Scavullo 1101

Surface Treatment
Chemical Treatment of Metal Surfaces—No. 2,856,275, 10/14/58—G. Otto 305
Surface Coatings—No. 2,874,080, 2/17/59—O. Schweitzer and E. Bader 1089
Treating Metal Surfaces—No. 2,856,312, 10/14/58—R. Nowak 305

Tin
Oiling Tinplate—No. 2,884,338, 4/28/59—G. Jenison 1298

Titanium
Bonding Titanium to Ceramics—No. 2,859,512, 11/11/58—P. Hovingh 518
Coating Titanium—No. 2,864,732, 12/16/58—R. Miller and R. Jefferys 749
Descaling Titanium—No. 2,861,015, 11/18/58—R. Simon 518
Production of Titanium—No. 2,848,395, 8/19/58—C. Carignan 64
Titanium Plating—No. 2,881,119, 4/7/59—L. Goldenberg 1191

Uranium
Anodic Treatment of Uranium—No. 2,872,387, 2/3/59—M. Kolodney 1188
Coating Uranium—No. 2,851,766, 9/16/58—A. Gray 184
Coated Uranium Article—No. 2,854,737, 10/7/58—A. Gray 304
Plating on Uranium—No. 2,884,364, 4/28/59—E. Reboe and R. Wehrmann 1402
Plating Uranium Surfaces—No. 2,872,389, 2/3/59—C. Slunder 1089

Zinc
Coating Zinc—No. 2,851,386, 9/9/58—H. Hartman 304
Electrowinning of Zinc—No. 2,848,399, 8/19/58—L. McGray and G. Lutz 64
Electrowinning Zinc—No. 2,863,810, 12/9/58—J. Henderson and H. Montague 748
Solderable Zinc Coating—No. 2,884,350, 4/28/59—E. Saubestre 1402
Zinc Plating—No. 2,860,089, 11/11/58—J. Jackson 518

Zirconium
Blanching Zirconium—No. 2,879,186, 3/24/59—W. Fischer 1188

ADVERTISING INDEX

This index is published entirely as a convenience. Every care for accuracy has been exercised. No assurance can be given, however, against inadvertent error.

A

Acme Manufacturing Co. ... 1338
Alchemize Corporation ... 1418
Allied Chemical Corp., General Chemical Division Third Cover
Solvay Process Division ... 1339
Allied Research Products, Inc. ... 1428
Aluminum Co. of America ... 1397
American Brass Company ... 1348
American Buff Company, The ... 1353
American Metal Climax, Inc. ... 1379
Apothecaries Hall Company ... 1421
Atlantic Compound Co. ... 1344

B

Baker Company, M. E. ... 1413
Becco Chemical Div., Food Machinery & Chemical Corp. 1413
Belke Manufacturing Company ... 1408
Better Finishes & Coatings, Inc. ... 1422
Branson Ultrasonics Corp. ... 1344

C

Carma Manufacturing Co. ... 1419
Chemical Corporation, The ... 1411
Cohn Mfg. Co., Inc., Sigmund ... 1398

D

Diamond Alkali Co. ... 1399
Diversey Corporation, The ... 1380
Diversey Corporation, The (Canada) Ltd. ... 1346
Dixon & Rippel, Inc. ... 1412
Duggan Masking Devices ... 1418

E

Enthone, Inc. ... 1329

F

Formax Manufacturing Corp. ... 1409

G

General American Transportation Corp., Kanigen Division ... 1342
General Plate Div. of Metals & Controls Corp. ... 1417
Gumm Chemical Co., Inc., Frederick ... Second Cover

H

Hanson-Van Winkle-Munning Company ... Fourth Cover
Harshaw Chemical Co., The ... 1332
Hull & Company, R. O. ... 1340

I

International Nickel Co. Inc., The ... 1401

K

Kocour Company ... 1412

L

Lasalco, Inc. ... 1334
Lea Manufacturing Company ... 1393
Lea-Ronal, Inc. ... 1394
L'Hommedieu & Sons Co., Charles F. ... 1407

M

Macarr, Inc. ... 1400
Mac Dermid, Inc. ... 1358
McGean Chemical Co., The ... 1347
Metal & Thermit Corporation ... 1343, 1351

N

Northwest Chemical Co. ... 1352
Norton Company ... 1337
Nuodex Products Co. ... 1349

O

Oakite Products, Inc. ... 1391

P

Professional Directory ... 1425

R

Raybestos-Manhattan, Inc., Manhattan Rubber Div. ... 1415

S

Schaffner Mfg. Co., Inc. ... 1396
Seeley Co., Inc., E. E. ... 1409
Sel-Rex Corporation ... 1345
Sellers Engineering Co. ... 1330
Sethco Manufacturing Co. ... 1416
Spraying Systems Co. ... 1400
Stevens, Inc., Frederic B. ... 1336

T

Tamms Industries, Inc. ... 1412
Technic, Inc. ... 1354
True Brite Chemical Products Co. ... 1424

U

Udylite Corporation, The ... 1350, 1355, 1405
Unit Process Assemblies, Inc. ... 1426
Unitron Instrument Div. of United Scientific Co. ... 1411
Univertical Foundry & Machine Co. ... 1416

W

Wyandotte Chemicals Corp ... 1341

Z

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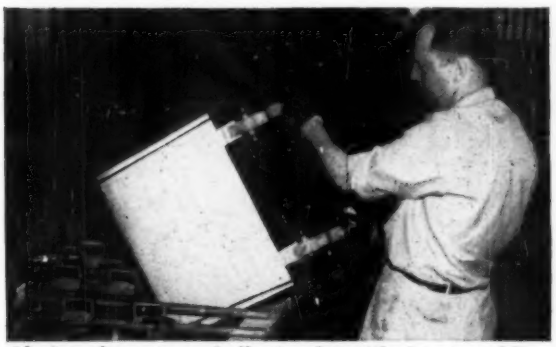
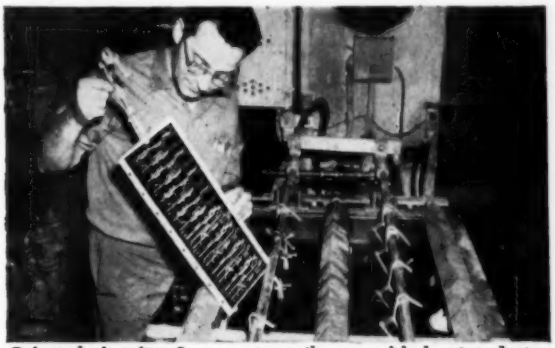
Copper Lead Lead-Tin Alloy
Nickel Tin

Bearings and other engine parts—Lead-tin alloys of low tin content, plated from B&A fluoborate electrolyte, will provide good corrosion and wear resistance as well as superior lubricating properties to protect bearings, pistons, other parts which require marginal lubrication during engine break-in periods.



Plating electrotype shells—Lead-Tin Fluoborate and Tin Fluoborate solutions made from B&A concentrates can be used successfully for plating electrotype shells. The lead-tin bath is employed where low melting deposits are desired, while the tin bath provides a higher melting point and faster rate of plating.

High-speed wire plating—The fast plating rate of B&A Copper Fluoborate makes possible high-speed electrocladding of steel wire and results in hard, high-strength deposits. For plating copper wire, B&A Lead-Tin Fluoborate solutions are used to produce a more uniform, more readily soldered product.



Printed circuits—Low cost, easily assembled printed circuits for radio and other electronic equipment may be plated economically and efficiently with B&A Copper and B&A Lead-Tin Fluoborates. Use B&A Copper Fluoborate for high-speed electroplating, followed by B&A Lead-Tin Fluoborate to give a deposit that may be easily soldered.

Other important operating advantages

B&A Metal Fluoborates come in ready-to-use concentrated solution form. Baths made from fluoborates have excellent stability, with ease of maintenance . . . have good covering power . . . give fine-grained deposits of good color.

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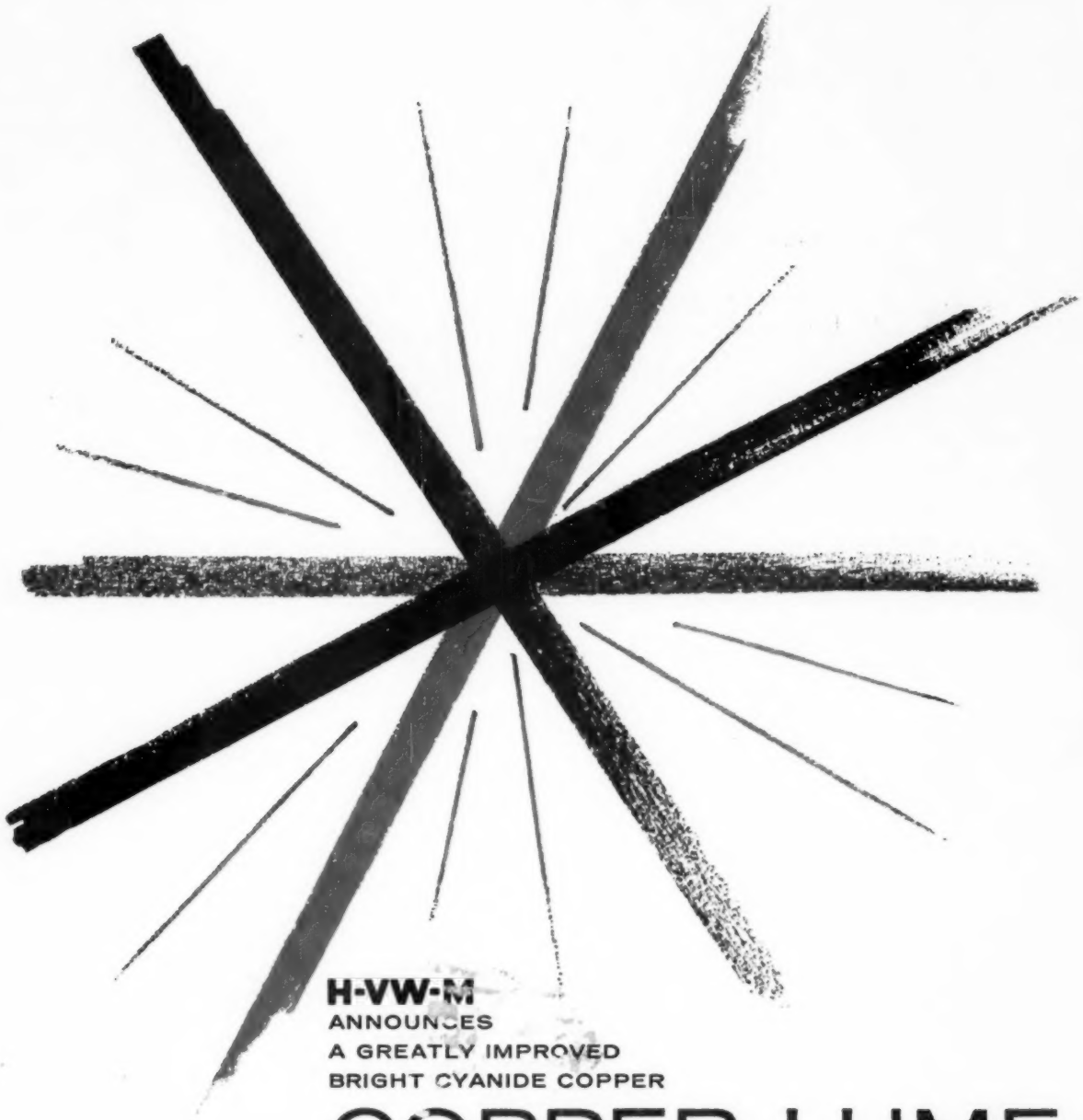

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